Manchurian Plague Prevention Service
Reports, 1918-1922.

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DR. WU LIEN TEH,

Director and Chief Medical Officer of Plague Prevention Service.

東三省防疫總辦兼總醫官
伍連德

NORTH MANCHURIAN PLAGUE PREVENTION SERVICE REPORTS

(1918–1922)

EDITED BY

WU LIEN TEH, M.A., M.D., B.D., (Cantab),
Hon. Litt. D. (Peking): LL.D. (H'kong): Sc.D.

Director and Chief Medical Officer of the Service; Physician Extraordinary to the President of China
sometime Scholar and Research Student of Emmanuel College, Cambridge; University Scholar and
Gold Medallist in Clinical Medicine, St. Mary's Hospital, London; Fellow of the Royal
Institute of Public Health, Royal Society of Tropical Medicine, Royal Asiatic Society;
Original Member of the Academy of Letters, China; Chairman of the International
Plague Conference, Mukden 1911; ex-President of the National Medical
Association; Author of various monographs and articles on
Bacteriology, Pathology and Medicine in Chinese,
British and American Journals.

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Tientsin:
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1922.

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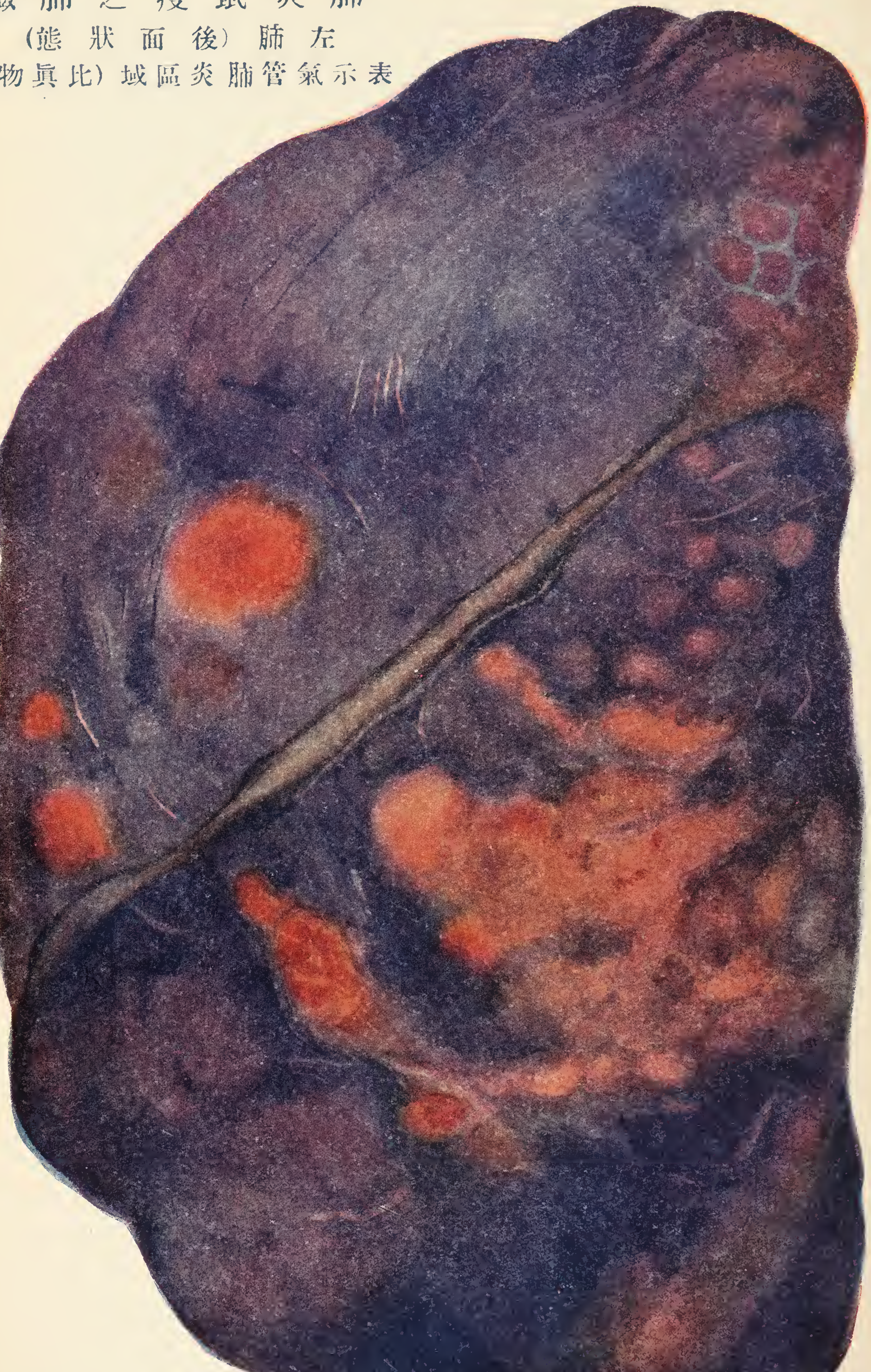
肺炎鼠疫之肺臟
左肺（後面狀態）
表示氣管肺炎區域（比眞物大）



LUNG IN PNEUMONIC PLAGUE
Left Lung (posterior aspect)

PREFACE.

The North Manchurian Plague Prevention Service was formally established on October 1st, 1912, with an annual appropriation of Taels 60,000 ($90,000) from the Customs Revenue. It maintains five hospitals at Harbin, Sansing, Taheiho, Lahasusu and Manchouli—strategic centres from a medical standpoint in North Manchuria. In 1920, the New Quarantine Hospital of Newchwang (Yinkow) was added to the list with an extra annual appropriation of Tls. 15.000, also from the Customs. Owing to constant political troubles in China, it has not been possible to adhere to the original plans of expanding the Plague Prevention Service into a comprehensive Public Health organisation for the rest of the country with headquarters at Peking. Had the necessary means been found, the plague question in cities like Canton, Foochow and other endemic regions in the southern and western provinces would have been more carefully studied, and these localities might not have proved such a menace to the people and commerce of China and other parts of the world. Compared to similar public health organisations elsewhere, the budget of the Manchurian Plague Prevention Service is indeed a modest one. The Medical Department of the Chinese Eastern Railway—Russian managed—spends about $1,200,000. a year, while the budget of the South Manchurian Railway—Japanese managed—contains an annual item of nearly Yen 2,000,000. for its medical service. In fact, the new Railway Hospital of 450 beds at Dairen, the construction of which has been entrusted to an American firm of contractors, will cost over Yen 3,000,000.

It seems hardly conceivable, but is true nevertheless, that after ten years of useful work, which includes the successful management of two big epidemics of plague and cholera, the annual appropriation of the Manchurian Plague Prevention Service is still an uncertain one, depending upon the approvals successively of the Ministry of Foreign Affairs, Ministry of Finance and Diplomatic Corps of Peking. An untoward accident or adverse decision at any one of these points might seriously affect the life or usefulness of this institution. During the last few years, the Harbin Hospital, which was built in the midst of the great epidemic of 1911 at a cost of $65,000.

provided by the then Viceroy of Manchuria, has shown signs of tumbling down. There being no special fund available, it has been necessary to save every possible cent from our yearly allowance of $90,000. As a result, the new Laboratory costing $17,000. was completed in September 1920, just a few months before the second Manchurian Plague outbreak, and the new In-patients Block with modern equipment for 40 general patients was finished in the middle of September 1922 at a cost of $30,000. At a time when the world is pointing at China as a country of self-seeking politicians and grasping militarists, it is well to know that in the domain of medical science at least there may be found a score or more of men and women ready at great personal risk to obey the call of duty to save life at a moment's notice and for a small remuneration.

This series of Reports (1918-22) is the third one that has been published by the Manchurian Plague Prevention Service. Incidentally, it commemorates the tenth year of the existence of the Service. The first five articles, dealing with our researches upon the epidemic of 1920-21, are entirely original and appear for the first time in print. Most of the other articles are reprinted from medical journals published in China, Europe and America, but all have been written by some member of our staff. It is hoped that these contributions may add to our further knowledge of Pneumonic Plague and other branches of medicine, and show what may be accomplished in cold and distant Manchuria even when we are handicapped by inadequate means and facilities.

In the preparation of these Reports, I have received the hearty cooperation of my principal colleagues, Drs. Chun Wing Han, Robert Pollitzer and Lin Chia Swee, to whom my best thanks are given. Dr. Lin Chia Swee is mainly responsible for the editing of the Chinese portion of the Reports, which are published in a separate volume by the Kwanghua Press, Peking.

To Messrs. R. W. Nicholls and A. Anderson of the Tientsin Press, Ltd. I am much obliged for their enthusiasm and care in turning out complicated scientific matter from a lay press. The coloured plate of a Pneumonic Plague Lung has been done by the Commercial Press, Ltd. of Shanghai, a purely Chinese-managed concern.

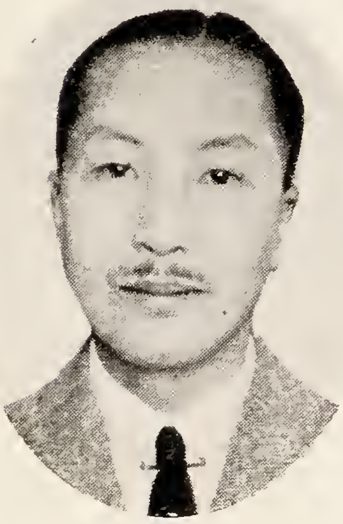
WU LIEN TEH.

Harbin, October 1st, 1922.

Dr. R. Pollitzer, Bacteriologist.
伯力士細菌檢驗醫官

Dr. Lin Chia Swee,
R.M.O. (Harbin)
林家瑞哈爾濱駐院醫官

Dr. Tang Tsung Nien,
S.M.O. (Taheiho)
鄧松年大黑河正醫官



Dr. J.W.H. Chun, S.M.O. (Harbin)
陳永漢哈爾濱正醫官

Dr. Ando Chu, S.M.O.
(Newchwang)
朱桐牛莊正醫官

Dr. Yuan Teh Mao, died Feb. 21, 1921.
of Plague while on duty
苑德懋醫官於二月間
因公染疫身故

Dr. Chen Ching, A.M O.(Harbin)
陳靜駐哈副醫官

Dr. Kwan Jen Min, R.M.O.
(Manchouli)
關任民滿洲里駐院醫官

Dr. Li En Chang, A.M.O.
(Lahasusu)
李恩昶拉哈蘇蘇副醫官

Dr. Shih Chi Liang,
R.M.O. (Sansing)
石冀良三姓駐
院醫官

Mr. Jen Shih Fu, Manager
任世輔總務科長

Mr. Huang Hao Kuan, Ch. Secretary
黃厚寬漢文秘書

Miss Kung Hsiu Chen,
Chief Nurse
宮秀貞女醫士

Mrs. Chen Chin Tsai, D.M.O.
陳金釵駐黑河女醫士

Miss Chen Chi Ching, D.M.O.
陳則敬女醫士

CONTENTS.

The Second Manchurian Pneumonic Plague Epidemic in Manchuria 1920-21. 1-54

I. General Survey of the outbreak and it's course.

A. Geographical.

B. General description of the outbreak:

C. Individual description of infected localities:—
1 Hailar, 2. Dalainor, 3. Manchouli, 4. Tsitsihar, 5. Harbin, 6. Changchun, 7. Suifenho, 8. Other infected foci in Heilungkiang, 9. Other infected localities in Kirin, 10. Infected localities in Fengtien Province (Mukden, Koupangtzu), 11. Vladivostock and Ussuri Districts, 12. Infected localities in Shantung and Chihli (Sangyuan district, Chefoo and district, Tsingtao):

D. Approximate expenditure of anti-plague work.

E. Chinese Refugees from Urga.

F. Tables—
1. Railway distances of plague infected towns from Manchouli.
2. Harbin district mortality.
3. Total admissions into plague hospital.
4. Number of plague deaths out of total admissions into hospital.
5. Number of patients sent from Isolation wagons into hospital.
6—9. Admissions into Harbin Plague Hospital (Feb.—May).
10—13. Contacts and Sick from Isolation wagons (Feb.—May).
14—18. Barometer and Thermometer readings (Jan.—May).
19—20. Plague mortality in Fuchiatien and Railway area, Harbin. (Feb.—May)
21. Plague deaths in Harbin, week by week.
22. Plague deaths in Manchouli, week by week.
23. Plague deaths in Dalainor, week by week.
24. Plague deaths in Tsitsihar, week by week.
25. Plague deaths at Shwangcheng Pu.
26. Plague deaths at Asheho.
27. Plague deaths in Vladivostock, week by week.
28. Plague deaths at Hailar, week by week.
29. Plague deaths at Yushu Hsien.
30. Plague deaths at Changchun.

Observations made during and after the second Manchurian Plague Epidemic of 1920-21. 55-82

I. Introduction. 55

II. Experiments with plague sputum. 56
- A. Exposure to direct sunlight and diffused daylight.
- B. Exposure to artificial cold surroundings.
- C. Exposure on wood and gauze.
- D. Experiments upon plague sputum and earth.
- E. Influence of disinfectants upon plague sputum—
  - 1. Action of liquid disinfectants.
  - 2. Action of slaked lime and milk of lime.
- F. Feeding experiments with plague sputum.
- G. Inoculation of conjunctiva with plague sputum.

III. Experiments carried out in plague wards. 65
- A. Experiments upon coughing.
- B. Infectivity of rooms occupied by plague patients and their disinfection.
- C. Examination of clothing and money from plague patients and cadavers.
- D. Animal experiments with urine of plague cases.
- E. Observations upon contacts and plague carriers.
- F. Experiments with protective masks.

IV. Experiments with mixed infections—spore-bearing bacilli and B. pyocyaneus: Vaccine and adrenalin. 73

V. Experiments upon non-susceptible animals. 80

VI. Summary of conclusions. 81

The role of the Tarabagan in the epidemiology of plague. 83-98

I. Natural plague in tarabagans 83

II. Experiments upon tarabagans— 86
A. Introduction: B. Inhalation experiments: C. Findings in inhaled animals: D. Findings in contacts: E. Experiments upon tarabagans.

III. Addenda— 97
A. Fleas and ticks of tarabagans: B. Tonsillar infection in tarabagans: C. Chronic plague met with in our animals.

IV. Summary of conclusions. 98

Tables 1-36 illustrating the two previous articles. 99-119

1. Exposure of sputum to direct sunlight, 2. Exposure of sputum to diffused daylight, 3. Exposure of sputum on wood and gauze, 5. Plague sputum deposited upon earth, 6 Plague sputum covered by earth, 7. Plague sputum mixed with earth, 8. Action of liquid disinfectants, 9. Action of alcohol and lime, 10. Action of lime, 11 Feeding experiments with plague sputum, 12. Experiments upon coughing, 13. Infectivity of

sick room. Agar plates. 14. Infectivity of sick rooms. Animals. (general tabulations and postmortems), 15. Action of formalin gas and sulphur fumes, 16. Examination of plague infected clothing, 17. Animal experiments with infected clothing, 18. Experiments with paper money and coins of plague cases, 19. Animal experiments with urine of plague cases, 20. Observations upon contacts and plague carriers, 21. Experiments with protective masks. 22—24. Experiments with mixed infections, Series I-IV, 25. Experiments with pyocyaneus vaccine, 26. Experiments with adrenalin mixed with vaccine or serum, 27. Cases of natural plague in tarabagans, 28. Diagram of tarabagan experiments 1921, 29. Diagram of tarabagan experiments 1921, 30. Results of tarabagan contacts 1921, 31. Diagram of tarabagan experiments 1922, 32. Results of inhaled tarabagans 1922, 33. Results of tarabagan contacts, 34. Experiments with cultures from alimentary tract of tarabagans, 1922, 35, Feeding experiments with tarabagans 1922, 36. Experiments with non-susceptible animals.

Clinical observation upon the second Manchurian Plague epidemic 1920-21 120-141

I. Introduction, Symptoms and signs of the disease 120

II. Note on the beginning and decline of the epidemic 124

III. Observations upon infectivity, epidemiology and incubation period. 127

IV. Notes on symptomatology and therapy.— 131
(a) Non-infective period at beginning of the disease,
(b) Observations upon cough and haemoptysis,
(c) Pain,
(d) Symptoms of in-coordination.
(e) Clinical observations upon urine and faeces.
(f) Duration of the disease,
(g) Cases among children.
(h) Non-pneumonic cases in 1921 epidemic.
(i) Therapeutic measures.

Tables—1. Bubonic cases observed at the beginning of the epidemic, Hailar.
2. Clinical chart of Farelkin bubonic case.
3. Sanitary personnel, Harbin Hospital.
4. Sanitary personnel, Dalainor.
5. Clinical chart of nine day plague case.

Pathological Findings in Plague Pneumonia, 1920-21 epidemic ... 142-165

I. Introduction. 142
(a) General, (b) Technique employed.

II. Classification of cases (according to lung findings). 145
Group A. Cases with marked pneumonia and pleuritis (19) 145
Group B. Cases with slight lung and pleural changes. (5) 152
Group C. Cases without pneumonia or pleural changes (9) 152

III. Observations. 154

IV. Findings in other organs. 155

V. Special case of mother and still-born. 161

Tables—1. Distribution of pneumonic areas in lobes of lungs. 164
2. List of P. Ms. showing conditions of lungs in Pn. Plague. 165

Salient Points about the 1921 Pneumonic Plague in Harbin 166
The recent Cholera Epidemic in China 1919. 181
The Management of the 1919 Cholera epidemic in Harbin. 197
Influenza, including its infection among pigs. 208
Notes on skin grafting. 215
Memorandum on Medical education in China. 220
Medical progress in China since the Republic. 217
The Menace of Morphine. 243
The latest phase of the narcotic problem. 247
Plague, Cholera and other epidemics, N. Manchuria 253
The Temple of Medicine in Peking 260
A Group of eunuchs in a Chinese Imperial Palace. 262
A picture illustrating self-mutilation. 264
New Quarantine Hospital at Newchwang. 266
Some problems before the medical profession in China. 268
Scientific medicine and Public Health. 273
Summary of Sixth Annual General Report, 1918. 279
Summary of Seventh Annual General Report, 1919. 286
Summary of Eighth Annual General Report, 1920, with appendix .. 295
Summary of Ninth Annual General Report, 1921. 303
Summary of Harbin Hospital Reports, Jan. 1918-Sept. 1921. 303
List of In-patient diseases at Taheiho, Sansing, Newchwang (Jan. 1918-Sept. 1921) 329
List of Out-patients, Harbin Hospital, 1917-21. 332
List of Out-patients, Taheiho Hospital, 1917-21. 334
List of Out-patients, Sansing Hospital, 1917-21. 336
List of Out-patients, Lahasusu Hospital, 1917-21. 338
Resumé of the work of Manchouli Hospital, 1921-22. 340
Revised Regulations for the appointment and promotion of Medical Officers. 347
Regulations and scale of salaries for the assistant staff of the Service 350
Proposed scheme of superannuation fund for the staff. 352

LIST OF ILLUSTRATIONS.

Frontispiece—Coloured Plate of a Pneumonic Plague Lung.

Attached to

i. Dr. Wu Lien Teh, Director and C.M.O. of P.P. Service .... Preface
ii. Medical Staff of P.P. Service .... ,,
iii. Medical and Administrative Staff of P.P. Service .... ,,
iv. Bird's eye view of east (plague) compound, Harbin Hospital ....Page 54
v. Harbin Hospital Main Laboratory, completed 1920 .... ,,
vi. Plague wards with attendants, March 1921 ,,
vii. Harbin Hospital (west administrative) compound .... ,,
viii. Harbin anti-plague staff, 1921 .... ,,
ix. How anti-plague masks are worn .... ,,
x. Semi-underground dwellings for miners, Dalainor .... ,,
xi. Public Burial Ground, Harbin .... ,,
xii. Dead plague patient showing plaster applied over spleen region by quack .... ,,
xiii. Plague patient (living) driven into the street ,,
xiv. Remains of dead horse eaten by a dog. A human plague corpse was refused by same dog .... ,,
xv. Harbin Laboratory (Interior) ....Page 82
xvi. Library of Plague Prev. Service, Harbin ... ,,
xvii. A corner of the Museum showing pathological specimens .... ,,
xviii. A group of Mongolian marmots or tarabagans ....Page 98
xix. Two pneumonic plague patients, one in the early and one in the late stages of the disease .... ,,
xx. Plague inhalation experiments. First stage ,,
xxi. Plague inhalation experiments. Second stage ,,

Attached to
xxii. Section of pneumonic plague lungs. Naked eye appearance ......Page 165
xxiii. Viscera of tarabagan 7, showing abscesses in lungs ...... ,,
xxiv. Human liver in pneumonic plague showing white patches ...... ,,
xxv. Posterior surface of left lung (P.M. 23) showing multiple haemorrhagic patches of lobular pneumonia ...... ,,
xxvi. Heart of tarabagan contact in inhalation experiment, which died six months after showing pericarditis ...... ,,
xxvii. Spleen of rabbit which died of chronic plague in 19 days showing multiple nodules throughout ...... ,,
xxviii. Viscera of stillborn (P.M. 8) showing fresh vegetations on bicuspid and tricuspid valves of heart ...... ,,
xxix. Congenital hypertrophied left foot. Three large toes were removed to enable shoe to be worn ......Page 261
xxx. Brass horse in Tung Yueh Temple, Peking ,,
xxxi. Main block of New Quarantine Hospital, Newchwang, opened 1920 ......Page 267
xxxii. Shanhaikwan plague blocks erected in 1911 ,,
xxxiii. Soft fibroma of arm before operation ......Page 321
xxxiv. Ditto after operation ...... ,,
xxxv. Cyst adenoma of ovary, before operation ... ,,
xxxvi. Ditto after operation. Wt. of tumour 9½ lbs. besides four basins of fluid contents ...... ,,

LIST OF MAP AND CHARTS.

A. Map of plague region, Manchuria 1921 ......*End of book*
B. Plague mortality chart in different localities (weekly) ...... ,,
C. Harbin daily plague mortality chart (Feb.-May, 1921), showing curve of total district as compared with that of deaths in Plague Hospital ...... ,,

THE SECOND PNEUMONIC PLAGUE EPIDEMIC IN MANCHURIA. 1920-21.

I. GENERAL SURVEY OF THE OUTBREAK AND COURSE.

A. Geographical.
B. General description of the outbreak.
C. Individual description of infected localities.
D. Approximate expenditure of anti-plague work.
E. Chinese refugees from Urga.
F. Tables (30).

I. GENERAL SURVEY OF THE OUTBREAK AND COURSE.

A. GEOGRAPHICAL.

Transbaikalia or Zabaikalia is a vast stretch of land lying to the north-west of Manchuria, bounded on the east by River Argun from China and on the west by Lake Irkutsk and Irkutsk Mountains from the Irkutsk region. Its most important cities are Chita (capital), Stretinsk, Nerchinsk, Kiakhta and Borzia. The region around Borzia for a hundred miles is composed of undulating hillocks inhabited by a species of large (cat-size) marmots or tarabagans (*arctomys bobac*) whose skin is much sought after for the manufacture of imitation sable. The Russians and Buriats find the flesh of these animals wholesome, and often hunt them for the meat and the fat which they use for greasing shoes. It is among the trappers and eaters of tarabagans that the early cases of bubonic plague are usually reported. Manchuria, which receives the butt of the attack whenever an epidemic of pneumonic plague arises, is known by the Chinese as Tung San Sheng (Three Eastern Provinces). It is the largest and easternmost province of China, containing an area of 363,000 square miles and a population at present of 22 million. Its three constituent provinces are :—

Fengtien (*capital* Fengtien or Mukden)
Kirin (*capital* Kirin)
Heilungkiang (*capital* Pukuei or Tsitsihar)

Of these, Heilungkiang Province adjoins Transbaikalia, the town of Manchouli being situation only a few miles from the boundary. The large province of Mongolia touches all three parts of Manchuria on the west. The country around Hailar, mostly Mongolian territory, is also a tarabagan infested region, and hence Manchouli and Hailar are the two principal skin-collecting depots in Manchuria, and any invasion of plague from the endemic regions is first reported in these two towns.

Beyond the regular caravan and cart routes, there are no proper macadamised roads in the rural parts of Manchuria. The Chinese Eastern Railway begins at Vladivostock (seaport of Maritime Province of East Siberia) enters Manchuria at Pogranitchnaya (Suifenho), traverses Kirin and Heilungkiang for 886 miles and leaves Manchuria at Manchouli Station. From Harbin (largest city of Manchuria), the Railway branches southward for 150 miles to Changchun (Kirin), where it joins the main South Manchurian line going to Dairen (436 miles). Other railway lines in or adjoining Manchuria are :—

a. Ussuri R. from Nikolsk to Habarovsk (410 miles)
b. Kirin-Changchun R. from Changchun to Kirin (77 miles)
c. Chengchiatun to Szupingkai (55 miles), branch of S.M.R.
d. Tashihchiao to Yinkow (14 miles) branch of S.M.R.
e. Peking-Mukden (523 miles)
f. Mukden-Antung (171 miles)
g. Antung to Seoul (310 miles) and Fusan (591 miles)

The principal seaports of Manchuria are Dairen and Newchwang (Yinkow), which have regular steamer services with Chefoo. Lungkow, Tsingtau, Weihaiwei (Shantung) Tientsin (Chihli), Shanghai, Canton, Hongkong (south China) as well as with different ports of Japan and Korea.

All these data have an important bearing upon any outbreak of Pneumonic Plague in Siberia or Manchuria.

B. General Description of the Epidemic.

For ten years, that is, since the great Plague of 1910-11, Manchuria had been freed from the pest, although almost every year, in the intervening period, sporadic cases were reported in some part of Siberia or Mongolia. For instance :—

In 1911 Bissemsky registered 5 bubonic cases at Scharasone.
In 1912 Haffkine reported 3 pneumonic cases at Chita.
In 1913 Some bubonic cases were reported in Kirghiz Steppes.

In 1914 we recorded 16 bubonic cases (13 fatal) in Transbaikalia
In 1917 we recorded bubonic cases at Patsebolong (Mongolia) resulting in the Shansi outbreak and 16000 deaths.
In 1919 we reported 2 bubonic cases (both fatal) at Ikievskaya.
In 1920 (August) 6 bubonic cases (5 fatal) occurred at Abagatui (5 miles) 3 at Dauria (40 miles) and 4 at Kailastu (50 miles).

In the following October, the wife of a Russian guard stationed on the Railway bridge at Hailar (117 miles from Manchouli) died of bubonic plague. Three out of five sons were infected and died, her husband was also infected but recovered in hospital. These cases were seen at the Railway Hospital and found to be purely bubonic.

Three Chinese soldiers living in the same compound also died of the disease. Owing to the free intercourse between the sick and some outside workmen, the infection was distributed in the city, and efforts at segregation met with opposition from the soldiers. During our stay at Hailar, we noticed the gradual evolution of the plague from the bubonic through the septicemic into the pneumonic form, due principally to promiscuous spitting and huddling together of coolies day and night in unventilated inns. Both here and at Dalainor later on, it was common to find all the inmates of one house numbering 4-8 or more dead of the plague within a few days. On December 12, the Chief of Police at Hailar (Lang), a keen officer was waylaid by soldiers when driving with our Medical Officer Tang, and had his scalp opened by a knock on the head. In spite of this, our record at Hailar was good for only 52 cases were altogether reported. Nine contacts then under observation in a large inn were set free by the soldiers and escaped by rail to different parts. Two reached the coal mines of Dalainor (100 miles), where they infected others in the crowded underground dwellings and thus really started the great epidemic of 1920-21. More than 1000 out of the 4000 Chinese miners died of the pest in this Dalainor district as a consequence. From Dalainor, persons incubating the disease escaped to Manchouli (20 miles away) where they were responsible for the deaths of 1141 people including 334 Russians. Contacts also reached Tsitsihar, where 1734 persons lost their lives, and also Harbin, where the deaths totalled 3125. Other towns on the Chinese Eastern Railway received the infection to a greater or lesser extent. Thanks to the rigid measures adopted at Harbin in controlling the regular passenger traffic, limiting the daily sale of third class tickets for each train to

50, medical inspection of all trains arriving and leaving, and quarantining for 5 days of third class passengers at Changchun (150 miles), the epidemic was practically stayed south of Harbin, and only 77 cases were reported altogether at Changchun and 4 at Mukden, as compared with at least 5000 in each city during the epidemic of 1911. The regular passenger traffic between Manchouli and Harbin was stopped on February 1st. but leakages occurred all along the line (584 miles), and many cases filtered in on freight cars and by road from the infected regions. The addition of a sanitary car to each passenger train perhaps helped in isolating cases found travelling with other passengers. Because of its size and commanding position, Harbin, in 1921 as in 1911, soon became the central focus of infection, but thanks to our early preparation we never lost control of the situation. In spite of the annoying opposition from soldiers and ignorant populace we succeeded in narrowing the spread of the epidemic to every possible limit. Beyond Changchun, very few plague cases were reported in Manchuria, such as. 4 at Kungchuling (picked from South Manchurian trains), 4 at Mukden, 18 at Koupangtzu (all traced to one family). A limited outbreak in south Chihli and Sangyaun (Shantung) costing nearly 200 deaths, including that of Dr. Yu Shu Fen (of our temporary staff) was believed to arise from two undetected Tientsin cases (Jan. 22). The port of Chefoo was infectedfrom Vladivostock, but all these instances will be described under separate headings. From Harbin, the epidemic travelled eastwards about middle of February, invading most of the stations of the Railway, and finally reached Vladivostock, where the first case was reported on April 9th. In this city the epidemic raged throughout the summer months and did not terminate until the following October, after causing the death of 520 persons. Altogether the 1920-21 epidemic claimed 9300 lives (including 600 Russians)

The rise and decline of the epidemic form an interesting study. As seen above, the first sporadic (bubonic) cases commenced in August 1920 in different parts of Siberia, e.g. Abagatui, Dauria and Kailastu. In October bubonic cases appeared at Hailar, the Russian woman who first caught the disease having made frequent visits to Manchouli near the Russian and Mongolian borders. Practically her whole family was attacked, only two out of five sons escaping. The outbreak was practically confined to this town during the months of November and December. After the attack upon the Chief of Police, cases first appeared at Dalainor early in January, and then rapidly multiplied. Tsitsihar reported its first case on January 18, the number rapidly increasing. It in turn infected other neighboring cities. Harbin received its first case from Dalainor-an escaped sick miner, who was diagnosed by us to be true plague on January 22. The highest mortality point was reached in Harbin on April 3. The last case in Manchuria was recorded before end of May. With the last vladivostock case in October, the second Manchurian plague epidemic may be said to have lasted exactly one year. In 1910-11, the first case in Transbaikal was also recorded about August. Harbin reported its first case in November and its last in the first week of April, but the epidemic stayed on in Mukden until middle of May. On that occasion, Vladivostock was not invaded, but several cities in Chihli and Shantung suffered badly, including Peking, Tientsin, Tsinanfu, Tehchow, etc. Strange to say, the two busy cities of Tongshan (coal mining centre 80 miles from Tientsin) and Yinkow (large Manchurian seaport), which used to be centres of *bubonic* plague arising from cases in Hongkong, entirely escaped in 1911 and 1921.

C. INDIVIDUAL DESCRIPTION OF INFECTED LOCALITIES.

1. *Hailar.*

Hailar being the first seat of infection that our staff visited during the 1920-21 epidemic deserves special attention. It is an interesting town, formerly in Mongolian territory. It consists of three parts :— (a) railway settlement including the station and containing about 2000 Russian inhabitants, (b) Mongolian area comprising the famous horse market, and (c) Chinese city, seat of the Taoyin of district. The total population is about 10,000. Since the Bolshevik troubles (1918), the Taoyin's rank has been raised to that of a Director-General (Tupan). At the time of my first visit to Hailar (24 hours by rail from Harbin) on November 28th. 1920, the station area was filled with hundreds of cars, thousands of Russian soldiers and their ponies under Kappel and Semenoff, who had just been driven away by the Bolsheviks in the west. It was fortunate that these were sent away within three days' otherwise some of them might have got infected by the plague and thus spread it broadcast.

It is always difficult to trace the origin of the early cases of an epidemic, but it was particularly so in a wild place like Hailar inhabited as it is by Russians, Chinese and Mongols. As far as I could ascertain, some suspicious deaths occurred on 4-7 October among seven Chinese coolies working in a small skinning factory situated a mile away on the northside of the railroad. Where these men came from, it was impossible to find out beyond the fact that they had something to do with skins. Their bodies were all voluntarily cremated in the compound occupied by them. The second group of cases was carefully studied by me on the spot. These began with a Russian woman Tarelkin (died Oct. 22) who was the wife of the Russian signalman on duty at the Hailar Railway bridge. Besides herself and her husband, there were five sons and twenty-one Chinese soldiers living in the same compound. Of these, her husband, three boys, and three soldiers caught plague, all dying except the husband. The last death occurred on November 25, i.e. 34 days after the first infection occurred in the compound. During my investigations, I attempted to secure some rats and fleas from the infected houses, but failed. There was no doubt, however, as seen from the list of cases, that they were of a bubonic type, some being treated in Hospital. The only case that recovered was old Tarelkin, aged 43 years, whose bubo in the left groin was opened.

The following information was supplied me by the soldiers on Nov. 29th. 1920.

> 21 Chinese soldiers, for duty at the Railway bridge, were living in two big rooms in the Tarelkin compound. They had a mutual kitchen shared by the Tarelkin family, the Russians moving freely among the Chinese. The Russian woman used to make regular visits to Manchouli (115 miles away), the last one being on August 13. She showed signs of plague on Oct. 22. and died the next day. Her fourth son, aged 9 years, got sick the same day and died also on Oct. 23. One soldier Chen had fever and rash on body on Oct. 23 and died two days after. After the woman and her 9 year old son died on Oct. 23., Tarelkin and 4 other sons removed to the same room occupied by sick Chen and stayed there for 5 days. No further sickness was reported for 24 days between Oct. 25. and Nov. 15. Then two Tarelkin boys, aged 18 years, became sick, were admitted to hospital with fever and buboes, and died—one on 17th. the other on 21st. A soldier Chang (aged 19) became sick on Nov. 17 with bubo in left axilla and died on the 19th. He was living with five other soldiers, though he used a separate wooden bed. One of these contacts, Chao, developed plague on 21st. was admitted into hospital on 24th. with bubo in left axilla, and died the following day. It was acknowledged by the soldiers that rats were present in the house, and they were frequently bitten by fleas, but they did not remember seeing any dead rats lying about. Besides their three dead mates at the Tarelkin compound, there were perhaps fifteen

other soldiers who had died suddenly in Hailar town about that time.

On November 13, one man was reported to have died at Yi Shun Inn after one day's illness. On Dec. 2nd. another sick man was admitted into Hospital from another Chinese inn (Yu Tai) with signs of plague and died after 14 hours. At autopsy, both these cases were reported to be septicemic plague. From this date onwards, the cases seen were few and far between, but whether alive or dead, buboes were rarely seen. In their stead septicemic plague was recorded at P.M. On Dec. 8th. a coolie was found dead of plague in an inn, which was then closed by the Police. Nine contacts were isolated. It happened that this inn was partly owned by a local soldier, who resented this interference with his business. He thereupon collected twenty others, and on Dec. 12th. waylaid the Chief of Police Lang while driving in a carriage with our Medical Officer Tang. Lang received a severe scalp wound with much bleeding, and the nine contacts were set free. Telegrams were dispatched by us to the Governor of Heilungkiang, and the Police who had up to now done their work splendidly, refused to go out again. The antiplague work came to a standstill for one week, during which no precautions were taken. Eventually, Police Chief Lang was prevailed upon to resume duties, but the plague had spread to other regions. The two ringleaders of the soldiers were tried by court-martial and shot, while their captain-a wild, uneducated man who at an anti-plague meeting publicly accused the doctors of having brought the plague, was fined and dismissed from the military.

Examination of passengers buying tickets was commenced on Dec. 18. Inspection of departing and arriving trains continued throughout.

One rat was found on December 23. and autopsied with negative results. After December 20th., cases with cough and bloody sputum were often seen. One report said that a man infected three out of four others in the same house. All the sick died and showed at postmortem congested trachea and bronchi with plague bacilli but no evident pneumonia. Four patients seen on Dec. 27. had pain in front of chest and epigastrium, dyspnoea, no head ache, light cough, bloody sputum. On 28th. December, an excited man rushed into the Police Headquarters and demanded that all anti-plague doctors be sent away from Hailar; the plague would then automatically disappear! After the punishment of the soldiers, our work became considerably easier, and a total of 52 cases was reported. The question of a sanitary cordon was raised and given up at that time. No more plague was reported at Hailar for some time (Jan. 1st.-Feb. 23) until some reinfections took place from Manchouli and Dalainor about end of December. This second invasion was however confined to the station area. Drs. Chun and Hsieh reported necropsy of a case seen alive on Jan. 15 with no cough or blood-spitting. The spleen was small and no buboes were noted. Blood and spleen showed P. pestis in large nos. Drs. were at one time or another on duty at Hailar. The unruly soldiers of Hailar might be compared to the wild country folk of Fengchen (Shansi) who surrounded the railway-car occupied by the foreign doctors and nearly murdered them (Shansi Plague 1917). The two Russian railway doctors Dr. Churigan (in charge of Railway Hosp.) and Dr. Adolph (ambulance), as well as their two bacteriologists Drs. Petin and Askanoff gave our staff considerable help. One Russian dresser employed in the P.M. room was infected while dissecting and died three days afterwards. The Chinese Police Chief Lang was a young, active, modern trained man, without whose cooperation it would have been most difficult to successfully limit the spread. That he was attacked while on duty by the undisciplined soldiers proved his devotion to the cause.

2. *Dalainor.*

To understand the extreme infectiousness of pneumonic plague, the example of Dalainor offers an instructive example. Here is a coal mine owned by the Chinese Eastern Railway and leased to a Russian Jew. The whole mine is scattered over an area about 3 miles square on flattish land, bounded on one side by low hills. There are five shafts worked by machinery to a depth of 150-200 feet in addition to shallow pits. The coal extracted is lighter and less lustrous than ordinary bituminous coal. It is in large slumps or slabs and does not ignite well, giving comparatively little heat and leaving an ash similar to that of wood. The daily output on a full day is 800,000 pounds. Except in the adjoining village, where a Chinese magistrate officiates, the administration is in the hands of the Russian lessee. The employees number 6000—2000 Russians and 4000 Chinese. The former occupy the higher positions while the latter form the bulk of actual miners. Besides these, there are 2000 dependents in the village. The Russians are housed comfortably in little cottages or open sunlit rooms built round the office building and have a club fitted with a small stage and restaurant.

The Chinese live mostly in semi-underground barracks scattered over the mining area. Each barrack measures 20 by 60 feet with accomodation for 60-80 men. The walls are built with coal-dust bricks, and the floors of mud. From the entrance, some ten steps lead to an underground five foot passage, on either side of which is situated a long *kang*-brick-and-mud hollow structure raised two feet from the floor and heated in winter by a flue within. Four feet above this is a wooden-tier running the whole length of the room, used for the same purpose of sitting, sleeping and eating. In one corner of the passage near the entrance, is a small open brick stove where kettles may be placed for heating water. Beyond one or two slits on the roof fitted with glass for the admission of light, these underground dwellings have no sun or ventilation. They keep warm in winter at a minimum expense of fuel, but are stuffy and serve as terrible plague traps whenever an epidemic breaks out. The men usually receive twice the wages prevalent in Harbin. In the adjoining village, brothels, gambling dens, opium resorts and tea houses abound, and as may be expected such a population is not amenable to discipline.

Into this community there arrived from Hailar on January 2nd. at 6 a.m. the sick friend of a mining coolie, who was among 17 living in a house. The sick man died at 6 o'clock the same evening. On the 7th. one of these 17 coolies was reported dead, on the 8th. one, on the 9th. two, on the 10th. eight, on the 13th. two, and on the 14th the remaining three. Not one person in that unfortunate crowd survived. On Jan. 4th., in another barrack housing 30 men, one man got sick and died. On Jan. 6th, in a third barrack containing 160 men another patient was found sick, sent to hospital and died a few hours afterwards. Of the contacts, over 42 were known to have taken the infection. On Jan. 11th, in a fourth but smaller barrack near the first one, four out of five inmates took ill at once, spat blood and died. One man remained healthy. On Jan. 16th one hospital attendant was reported sick, and the next day two more attendants sickened and died. Later on it was ascertained that 61 out of 64 coolies in one barrack died in 3 days as a result of infection from two outsiders. All this time, the medical control was in the hands of a Russian doctor Jejukavitch employed by the mines. The mine manager, Wedenikoff, an active man who had lived in America, appealed to us for help, and we immediately sent Drs. Chun and Yuan, and later on Drs. Hsieh, Chang and Chao, with sufficient dressers and equipment. I gave instructions that the contacts must not be kept in the infected barracks but removed to box cars in groups of 6-8, that they should stay out in the sun in the daytime, and that more police be lent to help in house-to-house inspection and to guard the hospital and cars. The rapidity of infection at Dalainor was principally due to the following causes:—

a. Crowded barracks, especially when the men refused to report when sick. By the time a corpse was found, several others had already been infected and some escaped to spread the plague.
b. Escape of sick and contacts from their places of confinement. Very often they returned again and again to the infected houses. Even in our Harbin Hospital we have seen one delirious patient trying to scale the wall and escape.
c. The ignorance and lawlessness of the miners in opposing all anti-plague measures.
d. The mistake made by the Russians in the early part of the epidemic in *shutting* up all contacts inside a barrack once a sick man was found, and only opening next day to sort out any further cases. A more crude way of isolation could not be imagined, but evidently this was done because of lack of spare buildings. (It was because of this that after the epidemic I insisted upon a Chinese doctor being associated with a Russian in the mines and the establishment of suitable blocks for isolation purposes.)

The mortality quickly rose. In the third week of January over 30 deaths were reported daily, and in the fourth week nearly 40. By Feb. 10th the mortality had registered 491. The highest point was reached on February 6th when 80 were recorded. When I I visited the mines on Feb. 11th all work had stopped, the dead were everywhere, and the population was well scared and more amenable to reason. In one house, eleven corpses were dragged out, but the friends still insisted upon going in to look over the papers left by the dead. The sanitary attendants while attending to the removal of the sick were often assailed, but fortunately the police was efficient and serious encounters did not take place. Under these conditions, the work of Dr. E. T. Hsieh who arrived on Jan. 21st and his assistants (Drs. Chang Chao, etc.) deserves every praise. Soon after arrival he fitted up a disinfecting and bath wagon, dressing room, with shower bath, and provided new clothes for patients and contacts. Contaminated clothes were disinfected in a special steam car. Assisting him were one ying of soldiers (90), 98 policemen and a staff of doctors, 11 dressers and 8 disinfecting assistants. The temperature in February was -20 to -25 C. 25 wagons were used for isolation. Steam from a small locomotive was used for disinfecting railway cars. The deaths were creamated in an old brick-kiln. As coal was free, large quantities were used. At one time when the epidemic seemed very serious, it was thought that the whole mining population of Dalainor might be induced to live in the open air for a full week, warming to be effected by large coal fires, while the infected quarters were being disinfected. This open-air existence would also prevent further infections, and the epidemic would automatically subside. But the cold was too severe and not many dared to brave the ordeal. However, this method of prophylaxis should be undertaken in all tropical or subtropical countries, where the weather conditions are favourable. The epidemic commenced to decline from Feb 10th, but fresh cases arrived from Manchouli. The last plague death at Dalainor was reported on May 19th, the total number registered having been 1017 (all Chinese except 4 Russians and 1 Japanese) out of a population of about 6,000. *Per capita* of population, Dalainor was the hardest hit of all places during the 1920-21 epidemic. In the outbreak of ten years ago, the mortality was insignificant, being 120 out of a population of 4000. On the staff, 8 soldiers, 1 Russian and two Chinese sanitary attendants died of plague.

3. *Manchouli.*

Manchouli or Manchuria Station is the western boundary town of Manchuria. Here ends the Chinese Eastern Railway, and the Trans-Siberian line begins. Mongolia is close by. The population numbers 21,000, of whom nearly half are Chinese, the rest being mostly Russians. The recent political troubles in Russia have driven thousands of families into China by way of Manchouli, and the most destitute Russians may be found in this town. The plague epidemic of 1910-11 entered China from Dauria (Siberia) by way of Manchouli and claimed 400 victims locally. The outbreak of 1920-21 also started in Dauria and Abagauti and the first Manchurian infections were reported at Manchouli. On this occasion, owing to the presence of thousands of poor Russians, who often lived underground with Chinese, the number of deaths among Russians was one-third of the total (334 out of 1141). In 1910, the Russian authorities took a leading part in the anti-plague work in this city; in 1920-21, owing to their disorganisation and lack of funds, our Service undertook the responsible share.

The first case was reported on Jan. 12, though a month previously rumours had been spread of its occurrence in this city. On the 17th two more deaths occurred, and on the 21st, one. The total for Jan. was 36. In February it had reached 475, in March it decreased to 318 and in April to 164.

The highest point was reached on Feb. 20th, with a figure of 70 (including 25 sick and 15 corpses found in one house). On Jan. 31st, 8 sick were found among 38 persons in a small inn, where one man had died of plague nine days previously. As at Dalainor in the early stages of the epidemic, no accomodation was available for the contacts who were either not isolated at all or were confined in the house where the sick had been. Hence the enormous number of sick and dead occasionally found in one building. After 40 wagons had been obtained from the Railway, matters improved considerably, but the multiplication of interests present was a great hindrance to efficiency. The mortality reached zero point on April 22 and stayed so for five days, but fresh infections were discovered on April 27, leading to a second small rise which continued until the 22nd of May. Dr. Kastorsky, a local Russian physician employed by the Municipality, gave the following reasons for the slow improvement:—improper organisation, no wagons at first for housing contacts, cold weather, fresh infections from Dalainor, Siberia and Mongolia, failure to report cases by Chinese, shortness of equipment, and the morphine habits of the Russian doctor in charge. The gentleman in question was dismissed in May.

The Russians had five doctors, six nurses, and 15 sanitary attendants on their staff. Our Plague Service personnel consisted of three doctors and four nurses among others. On the Russian side, there died of plague three nurses (including one woman), 15 sanitary attendants and one police. We lost none. The Russian sanitary staff was mostly untrained, very careless about wearing masks in the presence of the sick and dead. They smoked cigarettes while handling the dead, drank more alcohol than was good for them, and many were struck down unnecessarily. It was a sad story.

4. *Tsitsihar.*

Tsitsihar consists of two parts—the station town on the main Harbin-Manchouli line and the Chinese capital city (Pukuei) joined to the station by a light twelve mile railway. The station town has a population of some 5,000 people, while Pukuei contained about 90,000. It lies about one-third the distance from Harbin on the Harbin-Manchouli Railway, being 253 miles from Harbin and 623 miles from Manchouli. The journey from Harbin usually takes 8 hours. At Tsitsihar Station are large railway workshops, half the population being Russian. Pukuei is the seat of the Governor, who is supreme in all affairs of the Province. The modern hospital there was built by me in 1911 with funds provided by the local Governor, but since the opening its connection with the Plague Prevention Service has been indirect only, the annual expenses being defrayed by that city. On urgent occasions, I was consulted, as in February when General Sun Lieh Chen wired for me to see him and suggest the most appropriate measures for controlling the plague then rather threatening in the capital. The locations of the plague and isolation hospitals were excellent, the patients being housed in the commodious quarters formerly allotted to German prisoners. Dr. Hsieh Chiu Kuan, a graduate of Formosa Medical College, was in charge, assisted by a staff of able young men. The Police was active and made regular house-to-house inspection. As was usual in capital cities, much obstruction came from the influential classes in defying preventive measures, and the epidemic was unduly prolonged and claimed more victims than necessary. The first case occurred in a petty shop assistant who escaped from Dalainor and lived in the house of a friend, who was infected and died on Jan. 18. The wife followed and then five children, making a total of seven. These cases were hidden from the authorities, and when discovered other infections had already taken place. The Governor reported 11 cases (4 males and 7 females) up to January 23rd. The mortality records were as follows:—

For January 124, for February 661, for March 899, for April 44; total 1728. The males numbered 1390 and the females 338. The number of females was considerable because of the presence of many families in this city. Several deaths also occurred in the station area, corpses being actually thrown out of the passenger cars on two occasions. Some of the Chinese employees in the workshops also succumbed. At Tsitsihar station medical inspection of passengers was introduced from February 1st, but this did not prevent some persons in the early stage of incubation from taking the train and then falling ill in their homes after arrival.

5. *Harbin.*

As in the previous epidemic of 1910-11, Harbin was the headquarters of the anti-plague organisation, from which all instructions and reports were sent. For ten years this city had been growing in size and population until in 1921 the latter reached at total of 300,000, including 4,000 Japanese 100,000 Russians, and 2,000 other westerners. Harbin is the central station for trains proceeding to Changchun and the south; to Manchouli, Russia and the west; to Suifenho (Pogranitchnaya), Vladivostock and East Siberia. It is also the starting place for all river steamers plying on the Sungari and Amur. It collects grain, beans, oil, timber, skins, furs, etc., from the neighbouring districts for export, and is the main distributing centre for imported goods destined for North Manchuria and Siberia. It owns nearly 50 flour mills. 20 oil mills. 10 spirit distilleries and many breweries. Its Chinese merchants, mostly from Shantung, are, next to the Cantonese, perhaps the most forward in new enterprises of every description. Its regular lines of fine many-storied buildings along the main streets of the Chinese city (formerly a mass of mudsheds) are a lesson even to Shanghai. In fact, the city has grown ahead of the sanitary requirements, for there are no water works, no proper sewage system, no systematic collection of garbage and house wastes.

The richer Russians use water closets, but their municipal engineers do not yet understand the principle of septic tanks, still practise the cesspool method, and cart away the dejecta in iron tanks often to be conveniently dumped onto unoccupied fields near by. The Chinese city health work is still in the hands of untrained police officers, who only seek expert advice when a serious epidemic like plague threatens. Fortunately, the plague Prevention Service, with its largest hospital and principal laboratory situated in Harbin, has established a wide reputation throughout China, and by its successful control of epidemic and other diseases in the past has won the confidence of officials and merchants alike. When plague broke out in 1921, the ignorant classes were only half convinced, but they showed no open hostility. The real opposition came from the unruly soldiers, but even the hearts of these men were touched when they saw the tenderness and fearlessness with which Chinese doctors and nurses attended their friends in this most dangerous of all diseases.

As soon as the plague at Hailar showed signs of spreading. I called on Dec. 19. 1921. a meeting of the Chinese community at the Hospital attended by leading officials and representatives of the city. It was decided to start a local plague Prevention Committee, to prepare 20 railway wagons for purposes of isolation, to establish a special detention house for the Chinese city, and to wire the Governor of Kirin for $10,000 initial expenses. On December 21st. a meeting of Chinese and foreign residents was held at the Custom House ''to help in devising preventive and other measures against a possible epidemic in Harbin and surroundings''. An International Committee was forthwith organised with Mr. R. C. L. d'Anjou (Customs Commissioner) as Chairman. This Committee included all the consuls, higher Chinese officials, heads of the Railway, members of the Technical Board, business men, in addition to Chinese and Russian medical officers in charge of besides receiving reports rendered much useful service in obtaining the cooperation and assistance of those who might be unwilling when approached individually. This

Committee held altogether 18 meetings between Dec. 21. and May 23., after which it was dissolved.

The first plague case in Harbin was recorded on Jan. 22, when an ex-miner died suddenly in a house near the hospital after having arrived from Dalainor the previous day. Among four contacts (mother, sister, sister-in-law and male friend) who were admitted into our Hospital, only the sister-in-law took the disease on 26th. and died the next day. This patient had fever, fast pulse and tightness in chest the first day, developed cough, later on spat blood, and died in the evening. Her sputum and blood showed the plague bacilli in large numbers.

In a small village four miles from the Chinese city another miner from Dalainor died of plague on Jan. 26. Three men living in the same room with him also died, and in addition members of three neighbouring families, with the result that in this small village of 73 huts and 400 souls, eleven persons died of plague between Jan. 26 and Feb. 6. Fortunately owing to the early precautions taken at Harbin, all cases found were at once admitted into hospital, while the contacts were received in box-cars, each holding the members of one household (average six). It was evident that a trying time lay in front of us, and the whole efforts of the Service were concentrated upon limiting the outbreak to the smallest possible proportion. The plague wards could accomodate 60 sick, while the suspect wards had 50 beds. It was found that plague patients rarely survived beyond the second day after admission, as they were killed off so quickly. Sixty wagons were run on to a convenient siding easily approached from the New Town, Pristan or Fuchiatien—the three main divisions of Harbin. These wagons included a sanitary car, a kitchen car, a supply car; the rest were for accomodation of the many contacts. As seen from the table, we had at one time over 600 persons to look after.

STATISTICS OF CONTACTS IN ISOLATION WAGONS.

Month	*No. Admitted*	*Sent to Hosp.*	*Plague*	*Non-Plague*	*% Plague*
February	547	47	34	13	6,2
March	911	118	92	26	10,1
April	485	57	47	10	9,7
May	78	5	5	0	6,4
Total 4 months	2,021	327	178	49	8,1(Av.)

The work was under the supervision of Dr. Chapplick, who had a Chinese colleague as well as several assistants and a full sanitary staff. This was one cheerful spot in our daily duties, for upon its efficiency depended the saving of the lives of contacts. Temperature was taken morning and evening. As soon as any one showed signs of fever, especially with fast pulse, he or she was at once isolated and if necessary sent to the suspect ward of the hospital. Sometimes the rise in temperature was only temporary, and the patient was returned to the wagon. More often, the fever was followed by cough, red sputum and death. The 24 hours interval, usually between commencement of fever and cough, was most important, for at this stage the infective droplets had not appeared, and patient could be removed from his friends without any fear of their becoming infected. Should any carelessness or oversight take place, and the cough appear, then the inmates of the same car would run a serious risk of catching infection. The fact that the percentage of plague cases in the isolation cars reached only 8 out of 2021 admissions during the whole four months' epidemic showed that the work of Chapplick and his staff deserved every commendation. At Dalainor, where the same discipline was not maintained, 144 out of 655 contracts (21. 9%) died. The Russian settlement, comprising a larger area of land but much less crowded population, had a separate sub-office where the routine work of house inspection, diagnosis and disinfection was carried out, and the daily report sent to headquarters. All suspects and plague cases were sent to our Hospital in Fuchiatien, the few Russian sick (eight) being cared for in the Municipal Hospital. The Chinese city was divided into 5 districts, each with its corps of Police, dressers, inspectors, sanitary attendants, and disinfection squads. Patients were at once removed to hospital, while suspected corpses or dead found in the streets received spleen punctures. A simple method was employed :—Skin over spleen was painted with Tr. Iodine, and a short sharp knife sterilised with iodine was inserted and some contents were withdrawn. The cultivations on agar were made, the knife being then strokeed on two glass slides for microscopic examination. The whole operation usually took two minutes. In view of the very cold weather, strong wind and frequent exposure of corpse in the street, such quick operations were necessary. All cadavers found in the streets were sent to the common cremation pit to be burnt. Well-to-do and educated persons were sometimes thrown into the streets unclaimed, because the relatives after hiding them during sickness were afraid to report after death for fear of being isolated in the wagons. One of the most difficult problems of plague-prevention in China was this passive opposition of the populace in not reporting cases when alive and then throwing the bodies out when dead. If there had been co-operation between the public and the authorities at the beginning, the epidemic would have been more confined, but the cases were hidden and the families or friends were thus infected. This fear of isolation is prevalent in North and South China alike, and used to be the same in Japan until the new universal education of the masses produced its beneficial results. The dead in the plague-hospital, numbering 1312, were all cremated in two pits dug within its precincts. Each pit measured 12 by 12 by 10 feet deep. Large pieces of firewood were laid at the bottom, some bodies uncoffined were thrown in, then more wood, and so on. The fire was started by pouring two gallons of kerosene on the pile, and then lighting. The masses burnt fiercely in the open, because of the confined space, and even on cold windy days no difference was observed. In this way 80 to 100 bodies could be economically cremated every day with slight attention from two attendants. The fatty constituents of the cadavers helped to keep up the fire once it was lit, and at the end of the day only white crumbled bones were left as residue. Out of 1461 admissions into Harbin Hospital, 1312 were true plague cases, all died and were cremated. The remaining were non-plague and comprised such diseases as pneumonia, typhus, typhoid fever, tuberculosis with haemoptysis, influenza, bronchitis, catarrhal fever, etc.

Because of the large percentage of deaths, it was not surprising that rumours began to spread that we *took in* patients but did *not let them out*, and something uncanny must therefore have happened within the hospital compounds. Stories were current that our staff poisoned wells, flour and food in order to obtain a reward of $3. for each dead. My bulletin of March 13th. contained the following:—

> The past week has been a very anxious one for our anti-plague staff for the concentrated suspicion of and prejudice against our policy of removal of the sick to hospital, isolation of contacts, systematic inspection of inns and other sources of infection, closing of theatres, low brothels, etc., coupled with the restriction of railway traffic ad onr inability to cure the plague victims resulted in numerous rumours to discredit our dangerous and humane mission and in some instances to actual threats of physical violence to our members. For instance, the Chief Medical Officer was accused of shooting the sick in the plague compound and was threatened with a similar fate should an opportunity offer itself, our house-to-house inspection doctors were on several occasions faced with revolvers and knives in the course of their duty, while

> the sanitary assistants were almost obliged to swallow some of the disinfectants used in the disinfected houses.
>
> At Asheho a mob of sixty visited the isolation station, set free the two contacts confined there and chased the doctor in charge. It speaks well for the discipline of our staff that in the presence of so much provocation and the loss by plague of one of their leaders they have stuck to their duty and not resigned *en masse*.

To counteract these evil influences, we issued thousands of circulars, published a daily newspaper containing particulars about the sick and dead, reports from other infected localities, articles dealing with plague and health matters, etc. Our assistants also gave public lectures whenever possible and answered any questions that might be asked them by their audience. In fact our staff were faced with open attack from resentful and frightened persons as well as unseen danger from the plague germ. But all stuck to their duties with a cheerful heart. The masses refused to take sanitary precautions and yet expected to escape infection. But the time came when our efforts were bound to succeed, the mortality curve showed a steady decline from April 10th and finally reached zero point on May 15th. The Harbin epidemic thus lasted nearly four months and claimed 3125 deaths out of a population of 300,000, as compared with over 7,000 out of a population of 70,000 in the previous outbreak (1910-11). The death list might have been 30,000 or ten times greater if energetic measures had not been taken from the beginning. As it was, the epidemic was prevented from seriously invading the populous towns of South Manchuria and North China, less than 400 dying from plague in these latter regions as compared with 35,000 in 1910-11.

The daily ration of each contact kept in the isolation wagon consisted of:—meat ½ lb; potatoes ½ lb; carrots ¼ lb: white and black bread 2 lb; rice ¼ lb; sugar 4 lumps; tea twice daily. As the rice, though expensive, was not filling enough for the northerners, Chinese bread (*mantou*) was afterwards substituted.

The Railway area employed 11 physicians (mostly Russians), 40 dressers, 60 special Police and 125 attendants. Our Service deputed for special duty in Fuchiatien 8 doctors, 14 dressers, 50 special police, 20 hospital attendants and 42 sanitary attendants. But of these there died of plague:—one Russian doctor (Sinitzin), one Chinese doctor (Yuan Teh Mao), one Russian dresser, no Chinese dresser, 5 hospital attendants in plague compound, and one police sergeant. Seven burial coolies out of 18 employed in the public cemetery died of plague.

The River Sungari was opened for navigation on April 15 after all arrangements had been made with the Customs for medical inspection of passengers before purchase of tickets. Each steamer was obliged to carry a ship's surgeon on board. One suspected case of plague died on the first ship which left Harbin on April 16, but no further accidents occurred. and the river traffic was practically not interrupted.

A few interesting, sometimes humorous, episodes may now be related in connection with our anti-plague experience:—

a. Some of the most noisy detractors of our work were the native quacks who persisted in beguiling the public as to their ability to cure the disease. When patients came with fever and cough, they always gave hopeful prescriptions. If the sickness was not infectious, the patient got well and the quack's reputation jumped skywards; should it turn out to be true plague, both patient and quack often died. In Harbin alone, we recorded seven deaths among the old-style practitioners; one was the 'vice-president of the medical research society' whose body was thrown out into the street by his wife in order to escape isolation of the family. At Dalainor one quack after catching the disease passed it on to his wife and all four children. None survived.

b. As it was easy for any one who could read a few ancient books on medical practice to hang out a signboard, there were no lack of practitioners, and one influential group managed to persuade the Taoyin to hand over $4,000 of government money for the establishment of a plague house where native treatment could be undertaken. This house was opened on April 1st. (Fool's day) with twelve native physicians on the consulting staff each drawing a salary of $100. At their request we sent ten certified plague cases to them between April 1 and 4, but all died. On the 5th a letter was received from these worthies begging us not to send any more patients, as they had discovered that plague was incurable! The $4,000. had been absorbed.

c. The Inspection parties sometimes made mistakes. One man was sent in from the city because he had a fast pulse and had spat up something red. At hospital, we learnt that he had been eating crab apples and the red spit was due to them. Needless to say, the man went home delighted.

d. Most coolies were credulous and intensely ignorant about matters hygienic, but Dr. Chun (our Senior Med. Officer) got into conversation on April 9 with a Chinese carriage driver on his way home. The driver was young and pleasant and informed the doctor that on the previous day he was driving a fare when a policeman suddenly stopped his carriage and demanded where he was driving a *corpse* to. His live fare of fifteen minutes before had died of plague while in the carriage! The driver also said that he did not believe the rumours about doctors poisoning wells, food, etc., for he knew from experience that they were kind-hearted and treated all the poor well.

e. Ten years ago the plague reached its zenith at the end of January. Chinese New Year happened to fall on the 31st and firecrackers burnt on this occasion seemed to have a marvellous effect in ridding the city of pest. In 1921 the plague *began* in January, and no amount of firecrackers on Chinese New Year seemed to stay its virulence.

f. Many Chinese firmly believed in the efficacy of opium in keeping off plague, so much so that non-smokers were induced to try it during the epidemic. At Dalainor, a Japanese woman openly maintained an opium smoking and morphine establishment. Her business was most prosperous at the height of the epidemic. One day three plague corpses were found in her opium den. That served as an excellent reason for closing altogether her nefarious business, which at ordinary times might have required the cooperation of her consul.

Besides routine work, our laboratory in Harbin produced 60,000 cotton-and-gauze masks and 8,000 doses of anti-plague vaccine which were distributed throughout Manchuria and Siberia. Our research work is described in separate articles.

Some important instructions to the staff are appended.

ANTI-PLAGUE MEASURES I (issued Jan. 21, 1921)

1 *Sick.*

1. As soon as a suspicious case is reported, the Med. Officer must be informed, who will examine patient, and, if the case be plague, remove him to Hospital.
2. Every one in contact with a sick patient must wear a mask and hood to prevent infection. This can only come by nose and mouth. No antiseptics necessary for mask. Rinse mouth with warm thymol water afterwards.

3. No patient can be moved to Hospital without a certificate from Med. Officer. Police take note.

2. *Contacts.*

1. For the contacts the greatest care must be exercised, for it is these people who may later develope the disease and spread the epidemic. As soon as a person sick of plague is ascertained, all other persons in contact with him must be removed to the Railway wagon under escort to prevent escape. Inform them that they need not fear, for every care will be taken of them.
2. The contacts of the house must not be mixed with those of another. It is best not to have more than five persons in one car.
3. Watch contacts every day and have temperature and pulse taken morning and evening. Persons showing the disease will develope quick pulse and high temperature after 2-4 days. Report such cases at once to M. O. and later, if confirmed, remove to Hosp. Patients are not infectious until cough developes. Remove rest into new wagon.
4. Save every contact possible by watching them day and night. The greatest responsibility for this work falls upon the Police and staff in charge of the wagons, and no one must be allowed to escape or visit another car.
5. While under quarantine, the contacts had best be exposed to the sun in day-time to allow them to breathe the fresh air and have their face exposed to the sun. At night they can sleep inside.
6. Excellent nourishing food is provided from car kitchen.

3. *Dead.*

1. All persons dead of plague must be cremated in the pits dug for the purpose. By using the pit, the fire will be concentrated and the bodies and wood will help one another. Bodies found in city are cremated in public burial ground; those who die in hospital have a special pit inside compound.
2. D'ont be afraid of dead bodies, for once the sick cease to breathe the germs cannot escape from bodies. The danger from clothes of newly dead is great. To avoid danger from sputum such bodies should be first covered with lime or sprayed with disinfectants e.g. Sublimate solution 1 in 2000 or cresol 1 in 2000.

3. Those helping in post mortems must take the greatest care. All working in the room must use masks and rubber gloves, and any superficial wound must be attended to before going into room. Use gauze and collodion for surface wounds.
4. In case of well-to-do persons, who can affort proper burial, bodies must be covered with *raw* lime, placed in coffin, and buried in pit *7 feet deep.*

4. *Suspected cases.*
    1. Spleen Puncture. Provide spirit lamp, slides, agar tubes, knife platium needle, etc., in proper tray.
    2. Paint region with Tr. Iodine. Plunge sterile knife through 9th left space axillary region downwards and backwards. Pulp obtained will be dark red.
    3. Make cultivations in agar tubes.
    5. Make 2 smears on slides.
    6. Sterilise knife.

ANTI-PLAGUE MEASURES II (issued Jan. 21, 1921)

DISINFECTION.

1. *of Sanitary Staff.*
    1. Always wear mask properly over nostrils and mouth. One slip above and one slip below ear. Tie two ends behind neck.
    2. Put on rubber gloves and white over-alls before commencing work.
    3. In the open air, masks are not necessary. The danger lies in rooms occupied by sick persons and when speaking to sick persons.
    4. Throw away mask after using into disinfectant tub placed outside each ward. D'ont drop this mask anywhere.
    5. Wear long boots; rub soles of boots on disinfectant matting outside rooms.
    6. After work, gargle mouth and throat with Thymol water or Potassium Chlorate solution.
    7. Take a fresh bath whenever possible.
    8. D'ont visit unknown places.
    9. In plague wards, wear in addition goggles.
    10. For gloves, hands, delicate instruments, etc., use methylated spirit.

2. *of Sick Rooms.*
    1. Spray floor of room and lower walls with cresol 1 in 200. Cover floor with lime.
    2. Spread out as much as possible all sleeping clothes and bedding so as to expose them to action of 4.

3. Close windows and crevices of doors and partitions with paper.
4. Disinfect with formalin gas made as follows: (each 1000 c. ft.), 200 Pot. Permang, 200 water 400 formalin.

   Warm if necessary with spirit lamp or candle until room is saturated with formalin gas. This is the best way of disinfecting rooms in plague times.
5. Sulphur Fumigation. In place of 4 Sulphur powdered (2 lbs. for every 1000 ft.) may be burnt in an earthernware pot after walls and floors have been sprayed with water. Use lime always for floors.
6. No use wasting money upon carbolic acid, which can do very little harm to the plague germ in the room.
7. Repeat this disinfection a second time if needed.
8. Scrub floor with 1 in 4000 sublimate. and cover with lime.
9. Open room after one day and expose to sun.

Instructions to Medical Officers on Duty as Port Health Officers During Time of Plague. (issued April 13, 1921)

1. Be ready for duty from 6 a.m. to 6 p.m.
2. Wear Red Cross Yellow Quarantine badge over coat on left arm.
3. Inspect all incoming and outgoing steamers plying on the Rivers Sungari and Amur with with Customs Officers. Health Officers should search for all suspicious plague cases on board steamers after taking all precautions, like masks, disinfection, etc.
4. Obtain help of at least two Policemen if possible when examining steamers. All to be provided with masks made according to pattern sent herewith.
5. During the prevalence of the epidemic, the Hospital should be closed for ordinary cases, so that all your time may be devoted to anti-plague work. In the case of Sansing, Medical Officer should live for the time being at or near the Customs premises so as to be within call on arrival of steamer.
6. For disinfection of hands and thermometers, use only spirit. placed with cotton wool in a small wide-mouthed bottle with cover. D'ont use carbolic acid as this is useless against plague.
7. Prepare your Hospital for all emergencies as if a plague epidemic is prevalent. Reserve wards for actual plague cases, suspect cases and contacts.

8. Work in harmony with Customs Officers and be courteous to all people in the course of your duty.
9. For details follow instructions written on separate sheet.

PORT HEALTH REGULATIONS FOR STEAMERS PLYING ON SUNGARI AND AMUR RIVERS. (issued April 11, 1921.)

1. During the prevalence of the plague, all passenger steamers plying on the Sungari and Amur from Harbin to Sansing or any port beyond Sansing must carry a qualified doctor or trained dresser approved by the Director of the Plague Prevention Service.
2. Such doctor or trained dresser will receive a certificate from the Director, P.P.S. authorising him to act as ship's surgeon.
3. Duties of the ship's surgeon :—

    a. To examine on behalf of the company to whose ship he belongs, all passengers on board and to reject any one suspicious of carrying disease.
    b. To notify the Port Health Officer appointed by the Government of any suspected case of plague and to carry out quarantine instructions as provided by Customs.
    c. In case of death on board to supervise burial of corpse at nearest landing place after all anti-plague precautions,
    Namely :—sprinkle raw lime over corpse,
    bury corpse at least seven feet deep in dry land,
    cover corpse up completely with earth.
    d. To notify Port Health Officer at nearest port of any case of death or sickness.
    e. To, give facilities to Port Officer in the examination of passengers and other necessary information.

4. In Harbin the Port Health Officers will be specially appointed; at Sansing, Lahasusu and Taheiho the Medical Officers of the Plague Prevention Service will undertake their duties.
5. Before the departure of any steamer, Customs Officers and Port Health Officers will board such steamer. No vessel will be allowed to leave port until permission has been given by Customs and Health Officers.

6. On arrival of a steamer in port no passengers will be allowed to land until medical and Customs examination has been completed and the necessary permission given.
7. Vessel may only leave ports between 6 a.m. and 6 p.m.
8. Police specially deputed for the purpose will assist the Port Health Officers in their duties.
9. For infraction of the above regulations, fines will be inflicted according to Customs regulations.
10. The different shipping companies will be duly notified as soon as the plague terminates and these regulations are withdrawn.

6. *Changchun.*

Changchun is an important grain sentre, the southern terminus of the Chinese Eastern Railway (Russian-managed) and the northern point of the South Manchurian Railway (Japanese-managed). It is also the starting point of the Kirin-Changchun Railway (77 miles). It has a population of nearly 100,000 and is the seat of the Taoyin serving under the Governor of Kirin Province. In 1911 Changchun was one of the worst infected towns and lost more than 5,000 persons from plague. In those days it became also a great distributing centre of the epidemic, and the majority of infections in the southern localities could be traced directly to this source. When cases occurred in Harbin in January 1921, it was therefore most essential to keep Changchun as free as possible. Entire prohibition of railway traffic being impossible, the third class passengers were limited to a certain number each day. Hence, the limit of 50 for each train was fixed, the three daily trains thus conveying besides 1st. and 2nd. 150 third class passengers from Harbin to Changchun after undergoing medical inspection at the former station. Only persons with medical certificates could buy tickets. Medical Officers also boarded the train at big stations and examined would-be travellers at intervening places. When the trains arrived at the Kwangchengtzu station (Erh Tao Kao), anti-plague officers examined all passengers, and removed those in the third class cars to special observation depots where they were quarantined for five days, after which they were liberated if found healthy. For this purpose, the Chinese authorities had prepared ten different inns and houses with large courtyards and the Japanese two places (used by them in 1919 for cholera cases), each accomodating about 150 persons. Railway cars were also utilised when accomodation was insufficient. Although leakages happened along the 150 mile journey, especially at Misatzu station (20 miles north of Changchun) where the clever ones dropped off and completed the rest of the journey on foot or in carts, this system worked fairly well, and only 77 cases of plague were recorded in Changchun during the whole epidemic. Here as elsewhere, some of the military hindered our work by unlocking the railway cars and allowing the passengers to escape before the quarantine station was reached. The Taoyin distributed money among these worthies and implored them not to break our rules. Our work at Changchun was rendered much simpler by the cooperation of the Japanese authorities, with whom we had our first meeting on February 24 and fixed the quarantine arrangements. The first Chinese doctor sent to organise the sanitary arrangements was Dr. Yu Shu Fen (a former student of Kitasato Institute, Tokio), who afterwards died of plague at Sangyuan, Shantung (March 24th). The local plague hospital was situated near the Chinese Railway station (Erh Tao Kao). The commandeered inns were found ample for our quarantine purposes. On March 14th. a fire occurred in one of the S.M.R. cars used for detaining two plague patients, one of whom had died and the other was unconscious. It appeared that the clothes of the latter caught fire from the small iron stove as he dropped down. The woodwork of the car was completely burnt. After Dr. Yu left, other physicians were sent by the Ministry of Interior to take charge of the work at Changchun.

7. *Suifenho.*

Suifenho or Pogranitchnaya lies on the eastern extremity of Manchuria, where the Chinese Eastern Railway leaves Chinese territory and enters Eastern Siberia. The town is situated on a beautiful plain surrounded by high hills. Chinese and Russian Customs officiate here. When plague from Harbin threatened to invade the eastern regions, I proceeded to this town on Feb. 16th. and helped to organise the local International Anti-plague Committee on the lines of the Harbin one. Our Drs. Ling Ting Fan and Hsuan were placed in charge, assisted by the Railway doctor Gilleson. All trains arriving and leaving were inspected medically. The first plague case occurred in a Russian who died on 14th. March. He had arrived a few days previously from Nikolsk in the Primorsk region (East Siberia). We ascertained that cases had already occurred at Nikolsk since March 8-10. A Russian Medical Officer from Nikolsk visited our station on Feb. 21, and later on wrote that he had seen cases among Chinese in his town on March 8th. The second Suifenho case was reported on March 16th. Between this date and April 17th.

twelve cases were reported, ten among Chinese and two among Russians. Nine of the former were found in local inns, the tenth being caught at the station while trying to escape inspection. The first Russian patient has been described; the second was a nurse employed at the railway hospital.

8. *Other Infected Foci in Heilungkiang.*

Heilungkiang Province is separated from Kirin Province by the Sungari River. The Chinese Eastern Ry. traverses this province from Manchouli until just north of Harbin, when it crosses the fine iron bridge and then enters Harbin, and thus Kirin Province. Practically all the important stations lying on this route were more or less infected by the plague. These included (counting from west to east) Abagatui, (8), Dalainor (27), Hailar (175), Mentuho (282), Khingan (347), Buketu (371), Chalantun (487) Tsitsihar (623), Lamayantzu (707), Anda (757), Mankou (817), Tuichingsan (847), Station 62 (867), the figures after each city denoting the distance in miles from Manchouli. The scenery for 200 miles between Mentuho and Chalantun was most beautiful, the railway making many picturesque windings. But plague spared no spot, however beautiful, and during the epidemic *Mentuho* reported 4 cases, *Khingan* 3, *Buketu* 25, and *Chalantun* 1. Buketu had large railway workshops employing 1500 persons, and among the deaths were six Chinese in one family.

The Russian railway surgeon at *Anda* was 70 years of age, lame and half blind, and did not believe in the infectiousness of plague. At the time of our visit on Feb. 12th. he had made no preparations and did not consider these necessary. He handed us a long memorandum on the treatment of plague, which could rival any essay prepared by Chinese quacks. However, the engineer-in-charge undertook to carry out our instructions, and arranged 29 wagons on special sidings in the form of letter V. Sixteen of these were on one side and comprised cars for plague, suspects, kitchen, disinfection, bath and *personnel*, while the other siding were reserved for isolation cars. The first case at Anda was found on March 19, and altogether 25 died. At the next station Tuichingsan, the soldiers interfered with the work, and 8 out of the 28 deaths happened among them. An important city *Hulan* lies opposite Harbin. In summer, there is river communication between these two grain marts, but in winter the frozen river is crossed by carriage, and hence the sick could escape from one to the other. The magistrate in charge was quite go-ahead and followed the instructions of the missionary doctor there, Dr. McKillop Young, as well his Chinese physician. Proper measures were adopted, and the total mortality from

Feb. 7, when the first case was reported, to the termination in April was 322. In the 1910-11 outbreak, the deaths numbered over 4,000.

9. *Other Infected Localities in Kirin.*

From the second week of February, the plague began to extend its activities eastwards along the Railway. The first city to be attacked was *Asheho*, 40 miles from Harbin. A petty merchant Sun, whose people had died in Harbin, reached Asheho on Feb. 13. and stayed in the house of Liu. Sun spat blood on the 16, and died soon after. On the 19th. Mrs. Liu (aged 45) died of plague. No report was made to the authorities. Then came the police, who removed Liu, his son and daughter to isolation. All kept well and were released. Unfortunately, Liu was again exposed to infection, coughed up blood on Feb. 27, and died the following day. The local soldiers encouraged a mob of 60 to invade the isolation hospital, set free two contacts, and actually forced the latter into the quarters provided for our dressers. This was too much for our Medical Officer, Liu, who left the town before instructions reached him from Harbin. The local magistrate was slow and did little to help the sanitary staff. The gentry undertook most of the responsibility and employed a pharmacist to look after affairs. In the workhouse, 40 inmates took the infection and died. In many cases whole families were wiped out. Deaths totalled 123.

Other important towns lying on the railway east of Harbin are :— *Imiampo* (153), *Shitao Hotzu* (210), *Hantao Hotzu* (255), *Hailin* (313), *Mutanchiang* (332), *Mulin* (402), *Machiaoho* (433), *and Suifenho* (512), the figures denoting distance in miles from Harbin. All these places were more or less affected, but in no case seriously because of the scarcity of population.

The tract going southwards from Harbin passes the following towns :— *Shwangcheng* (31), *Taolaichao* (76), *Yaomen* (101), *Misatzu* (125), the figures denoting mileage from Harbin. The magistrate at Shwangcheng was old-fashioned and allowed the plague to run its course. Fortunately, owing to the strict measures adopted at Harbin, only a few dripped into this city, and the total deaths numbered 134. The mortality in the other cities was not great.

From Changchun, the Kirin-Changchun Railway runs for 77 miles to the capital city Kirin, a residential centre. No cases were reported in Kirin, but a few were encountered along the line, having travelled by road from Misatzu where they escaped inspection quarantine.

A large city *Yu Shu*, lying 100 miles south of Harbin but not on the railway line received its first infection on March

8th. The magistrate Mo had served as Chief of Police in Fuchiatien in 1910-11, and was there fore *au fait* with the elementary principles of plague prevention. He adopted the strictest precautions, sent his police to surround the city, telegraphed for some assistants from us, made house to house inspection, isolated contacts from the sick and cremated the dead. In this way he did good work. The plague claimed in his district 253 victims out of a scattered population of 50,000. Over one third of these were females.

10. *Infected Localities in Fengtien Province.*

With our preventive measures adopted in the north and the watchfulness along South Manchurian Railway, the only cases which escaped detection were those incubating the disease. At *Kungchuling* station (40 miles from Changchun) one sick second class passenger was caught on Jan. 31. in the train. He had travelled overnight from Harbin in the second class and had not therefore been quarantined. Three more cases were similarly discovered, and removed.

a. *Mukden.* Mukden, being the capital city of Manchuria, the Governor-General was early communicated with. From the beginning he appointed me supreme chief of anti-plague operations, and wired to all subordinates including the military, to obey instructions. He had an efficient staff in Mukden, and was assisted by Dr. Christie's staff and the Japanese. The first case occurred on March 29 at Siao Si Men (small west gate), who was found in an inn with 36 others. The servant at the inn caught the infection and died. A third case (corpse) was found on April 1 near the Chinese Railway station dressed in uniform. The fourth and last one occurred in the city, and strict measures prevented further spread. Hence the record of Mukden in 1921 was excellent. In 1911, about 5,000 persons died in this city.

b. *Koupangtzu.* An interesting localized outbreak was found at Koupangtzu district, where the Peking-Mukden line branches off to Yinkow (Newchwang) 90 miles away. A man Li arrived from Changchun on March 17 and lodged with a family named Wang at the village of Lo Chia Tun (9 miles north of Koupangtzu). A wedding was in progress and guests (male and female) were busy playing *machiang* (dominoes). Li died on the 19, followed by four of the Wangs and two others including the bride-to-be Altogether seven died of plague. Kao Chia Tun (a village half a mile away) was infected by one of the guests, and lost 11 persons. The outbreak lasted from March 17 to April 4. All the sick had fever, cough and blood spitting. The local epidemic cost 18 lives and was due to one sick man arriving among a happy party.

11. Vladivostock and Ussuri Districts.

For some time reports had been received from Vladivostock as to the progress of the plague in that district. The first case was detected on April 9. From the first the Russian authorities appeared to have taken very strict measures. On May 24th. Drs. Chapplick, Loshiloff and myself porceeded in a special car to Suifenho and Vladivostock. After staying the day at Suifenho, we arrived at *Grodoveko*, the Russian station on the other side. Here we met the Japanese military surgeon Iyeda, who a few weeks previously had come to Suifenho with twenty wagons for carrying out anti-plague work in Chinese territory. He informed me that the Russians closed up a whole house with the inmates as soon as a case of plague occurred. *Nikolsk*, where the Ussuri Railway proceeded northwards to Habarovsk (420 miles) was reached three hours afterwards. We found over 40 cars reserved for anti-plague work by the Russians. As soon as any suspected cases was detected, all the other passengers in the same car went into isolation. The isolation cars were surrounded by barbed wire. The first true case of plague occurred on March 17 in a passenger probably from Harbin. A total of 16 deaths was reached in this city. Vladivostock (70 miles from Nikolsk and 488 miles from Harbin) is a beautiful seaport, the eastern terminus of the Trans-Siberian railroad. The Russian doctor in charge was Popoff, a keen man, former assistant of Zabolotny with whom I had worked in 1911. A revolution was then on, and Popoff was on the point of being taken prisoner by the new masters (Kappelists). We found him at home however after three hours' search. His anti-plague organisation was somewhat complex. He employed nearly 1000 persons with a monthly budget of 200,000 yen. He had suboffices at Olga, Ugolskya Suchan and Habarovsk. At Vladivostock, there were 4 separate pest-houses, each with 8 beds (32), 14 isolation rooms each with 4 beds (56), and accomodation for 500 contacts in a military barrack. At the railway station were 4 wagons for isolation and one for sanitary staff. The staff consisted of 27 doctors at Y320. each, 40 dressers at Y230 each, 420 sanitars at Y140 each. Up to May 26, there had died at *Nikolsk* 16, at *Vladivostock* 240, at *Olga* 6, at *Uyolskaya* 9, and at *Suchan* 6. Among the staff there had died two dressers, 3 sanitars and 1 sister at plague hospital (out of 8 employed). Compensation in case of death was 2/3 of monthly salary to widow or nearest relative for the rest of life. One dresser and one sanitar were infected while working in city; 1 dresser, 1 sister and 2 sanitars while in isolation hospital. Estimated population of Vladivostock (R. 100,000, C. 60,000, J. 30,000) Nikolsk (40,000) and Habarovsk (30,000).

The following are the mortality figures at Vladivostock :—

April 9 — May 20..............286
May 21 — ,, 25.............. 81
May 26 — June 14..............102
June 15 — Oct. 15.............. 48 Total 517.

Two cases of bubonic plague were seen—one on July 10, the other on Aug. 10. Five infected rats were found on July 23 and two on Aug. 10. It would be interesting to know how widely the rates were infected. Dr Popoff died the following October from poison by his political enemies.

12. Infected Localities in Shantung and Chihli.

a. Sangyuan District. About the middle of February, after the plague had been making some strides in Harbin, startling news came from south Chihli and the adjoining Sangyuan district of Shantung that many deaths from pneumonic plague had been detected in the villages. Medical assistance was rushed to the spot from Peking and Tientsin, including Chinese, American and French doctors. From Dr. C. W. Young's investigations, it appeared that a man Chang living at Chang Chia Wa village visited Tientsin about Feb. 1 to buy a trousseau for his daughter, and died on the 4th. soon after his return. His whole family of 8 caught the infection and died; altogether 40 persons fell victims in this village, every one traceable to Chang. Another man Wang visited the locality, returned to his home at Sangyuan on the Tientsin-Pukow Railway and infected his whole family, all of whom died except a small boy. Other families were also infected leading to about 120 deaths. The railway was practically stopped for some time, and only the express-trains to Shanghai ran. With later improvement, the service was extended. but the trains avoided the infected districts. The plague continued throughout April, and the last case was reported early in May. The usual train service was resumed on May 6th. Altogether 200 persons died of plague in these parts.

b. Chefoo and District. On May 4th, Chefoo was startled on hearing that the Russian Volunteer Fleet steamer *Kishinev*, just arrived from Vladivostock, had two cases of plague on board. The Port Health Officer, Dr. Malcolm, who examined the passengers found that one patient died soon after the steamer left Vladivostock, and the second a short time before arrival at Chefoo. Nearly 200 deck passengers were on board. There being not quarantine station ready, the vessel was isolated with all on board. Five more deaths occurred the next two days, and by the 10th, the mortality had risen to 16, all from pneumonic plague. A deserted spot, Kentucky Island near Chefoo was found, where the survivors were landed, matsheds were hastily erected and food was brought ashore. 108 of the contacts escaped on the 5th. leaving only 4, and this produced a panic in the city. Fortunately, no further cases were reported. On June 8th the British steamer *Ralph Moller* reached Chefoo from Vladivostock, and reported three deaths from plague on the voyage. The passengers, numbering about 700, were removed to Kentucky Island, this time better fitted for the purpose. H. M. S. *Marazion* and two submarines stood on guard, searchlights were thrown on the island at night, thus preventing any one from escaping. The quarantine period having expired without mishap, the passengers were liberated. Strict measures were enforced in Chefoo city, but no local cases developed. In the meantime, five deaths had happened up to May 24 in a neighboring village, *Ninghai*, ten miles east of Chefoo. These were traced to one man who escaped from the island on May 5th. There was no further accident, and the Chefoo outbreak closed with a mortality of 24.

c. *Tsingtao.* The British steamer Kiangsi from Vladivostock and Shanghai arrived at Tsingtao on June 4 with a case of pneumonic plague on board. This was followed on the 7th. by the death of the mother from the same disease. No more cases were reported at Tsingtao.

D. APPROXIMATE EXPENDITURE OF ANTI-PLAGUE WORK.

During this last epidemic, the expenditure was much less than that of 1910-11, when it ran into eight million dollars. So far as I can make out, the following sums were expended in 1920-21 at different places:

Sum expended.	*Source.*	*Authority.*	*Locality spent*
Tls. 200,000	Canton Customs surplus.	Ministry Interior	Sangyuan district.
Y. 170.000	S. Manch. Rly.	Japanese	Along S.M.R.
$20,000	Mukden Governor	Governor	Fengtien.
$80,000	Customs	Ministry Interior	Changchun district.
$200,000	C. Eastern Rly.	Management	Along C.E.R.
$100,000	Harbin Munic.	Municipality	Harbin district.
$50,000	Manchouli	,,	Manchouli.
$40,000	Dalainor mines	Management	Dalainor.
Total about $960,000.			

The Director of the North Manchurian Plague Prevention Service received $150,000 from the Customs for operation in N. Manchuria. The Service itself spent only $38,000 out of this sum.

Accounts are as follows:—

Received from Customs	$150,000.00	Paid out to Harbin Taoyin	$60,000.00
,, ,, Heilung Governor	1,000.00	,, ,, Heilung Governor ...	20,000.00
,, ,, Miscellaneous sources	518.50	,, ,, Kirin Governor	20,000.00
		,, ,, Plague Prevention Service .	37,717.85
		Balance left with Customs accountant	13,800.65
Total	$151.518.50	Total	$151,518.50

Grand total for whole epidemic $1.111.518.50.

E. CHINESE REFUGEES FROM URGA.

Early in February 1921, we received urgent requests from the civil and military authorities to aid ten thousand destitute Chinese refugees who were returning to China after the sack of Urga by the mad Baron Ungern and his hordes. As the plague was then at its height at the principal stations through which these people would pass, it was most essential not only to provide suitable cars but also to make all sanitary arrangements so as to prevent any possible infection. There would be no quarantine, provided the refugees were confined in the cars under proper escort, when the trains stopped at the various stations. Our Medical Officers at Manchouli, Buketu, Hailar, Tsitsihar and Harbin were instructed to take every precaution and to affix a seal upon the right sleeve of each person for identification, About fifteen trains were used altogether, food being provided them by the Chinese government at different places. The Russian and Japanese railway authorities coperated heartily in this rescue work, and although the evacuation took over one month to complete, no mishap occurred, and the refugees reached their several homes without introducing one case of plague.

The following figures were passed at Manchouli:—

March	22	1,278
,,	29	1,174
,,	30	1,548
April	3	1,728
,,	8	1,328
May	8	79
,,	15	1,517
,,	19	1,267
	Total...........	9,919

WU LIEN TEH.

F. TABLES (30).

(1) RAILWAY DISTANCES OF PLAGUE INFECTED TOWNS FROM MANCHOULI.

沿鐵路直線計算染疫各城鎮距滿洲之遠近

Manchouli to: 滿洲里至:

,,	Dauria	,,	道利亞	40	miles	westwards.	英里向西		
,,	Borzia	,,	包爾茲亞	80	,,	,,	,,		
,,	Abagatui	,,	阿巴噶圖	5	,,	eastwards	向東	and southwards.	向南
,,	Dalainor	,,	札蘭諾爾	18	,,	,,	,,	,,	,,
,,	Hailar	,,	海拉爾	117	,,	,,	,,	,,	,,
,,	Tsitsihar	,,	齊齊哈爾	415	,,	,,	,,	,,	,,
,,	Harbin	,,	哈爾濱	584	,,	,,	,,	,,	,,
,,	Changchun	,,	長春	730	,,	,,	,,	,,	,,
,,	Kirin	,,	吉林	807	,,	,,	,,	,,	,,
,,	Mukden	,,	奉天	920	,,	,,	,,	,,	,,
,,	Vladivostock	,,	海參崴	1,072	,,	,,	,,	,,	,,
,,	Dairen	,,	大連	1,061	,,	,,	,,	,,	,,
,,	Shanhaikwan	,,	山海關	1,181	,,	,,	,,	,,	,,
,,	Tientsin	,,	天津	1,357	,,	,,	,,	,,	,,
,,	Tehchow	,,	德州	1,470	,,	,,	,,	,,	,,
,,	Sangyuan	,,	桑園	1,510	,,	,,	,,	,,	,,

(2). HARBIN DISTRICT MORTALITY.

	Hospital.	*City.*	*Railway.*	*Total.*	
Jan.	2	0	0	2	(first case 22 Jan.)
Feb.	98	110	47	255	
March	597	480	396	1473	
April	609	426	296	1331	
May	6	55	3	64	(last case 24 May)
	1312	1071	742	3125	

(3). TOTAL ADMISSIONS INTO PLAGUE HOSPITAL.

	From Railway Area	*From Fuchiatien.*	*From Wagons.*	*Elsewhere.*	*Total.*	*Plague Deaths.*
Jan.	0	2	0	0	2	2
Feb.	22	57	47	0	126	98
March	120	367	117	37	642	597
April	133	356	57	117	663	609
May	9	13	5	1	28	6
	284	795	227	155	1461	1312

(4). NUMBER OF PLAGUE DEATHS OUT OF THE TOTAL ADMISSIONS TO PLAGUE HOSPITAL.

	From Railway Area.	*From Fuchiatien.*	*From Wagons.*	*Elsewhere.*	*Total.*
Jan.	0	2	0	0	2
Feb.	20	44	34	0	98
March	116	357	92	32	597
April	129	330	47	103	609
May	1	0	5	0	6
	266	733	178	135	1312

(5). NUMBER OF PATIENTS SENT FROM ISOLATION WAGONS TO PLAGUE HOSPITAL.

	No. of contacts in wagons.	*No. of sick sent.*	*No. of Plague cases diagnosed.*
Jan.	0	0	0
Feb.	547	47	34
March	911	118	92
April	485	57	47
May	78	5	5
	3021	227	178

(6) ADMISSIONS INTO HARBIN PLAGUE HOSPITAL.

Date		FROM RAILWAY AREA							FROM FUCHIATIEN							From Wagons	From Elsewhere	Total Admissions	Plague Deaths.	Non-plague Deaths.	Alive.
		I	II	III	IV	V	Etc.	Total	I	II	III	IV	V	Etc.	Total						
February	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
,,	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
,,	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
,,	4	...	...	...	...	...	...	...		...	...	...		...	...	...	...	...	...	...	...
,,	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...
,,	6	...	...	...	...	...	...	...	...	...	...	...	1	...	1	4	...	5	1	...	...
,,	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	4	...	...
,,	8	...	...	...	...	...	3	3	...	...	...	...	...	...	...	...	...	3	2	1	...
,,	9		...	...	...	...	...	...	...	8	...	...	...	...	8	2	...	10	8	...	...
,,	10	...	...	...	...	...	...	...		...	...	1	...	...	1	...	...	1	1	...	...
,,	11	...	...	1	...	...	...	1	...	...	...	...	...	...	...	1	...	2	2	...	...
,,	12	...	...	...	...	...	1	1	...	6	...	...	...	...	6	...	...	7	1	...	...
,,	13	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	1	5	1	1
,,	14	...	...	...	...	...	...	...	1	...	...	...	...	...	1	3	...	4	...	...	1
,,	15	1	1	...	1	...	...	3	...		...	...	...	...	...	5	...	8	5	...	5
,,	16	...	...	...	1	...	...	1	...	4	...	...	...	...	4	1	...	6	6	...	...
,,	17	1	...	...	...	...	...	1	...	8	...	...	1	...	9	2		12	4	...	...
,,	18	...	...	...	1	...	1	2		...	...	...	1	...	1	1	...	4	5	...	3
,,	19	...	...	...	...	1	...	1	1	5	...	...	...	...	6	4	...	11	6	...	...
,,	20	...	...	...	...	...	...	...		...	...	...	1	...	1	10	...	11	6	...	...
,,	21	...	...	...	...	...	...	...	1	...	...	...	1	...	2	2	...	4	9	...	4
,,	22	...	...	...	...	...	...	...	...	2	...	...	...	...	2	2	...	4	5	...	3
,,	23	...	...	...	...	...	...	...	1	...	...	...	...	...	1	2	...	3	3	1	3
,,	24	...	...	...	1	...	...	1	...	...		...	...	...	...	1	...	2	3	...	1
,,	25	...	1	...	...	...	...	1	...	...	1	...	1	...	2	1	...	4	3	...	2
,,	26	...	1	...	...	...	1	2	1	...	1	...	3	...	5	1	...	8	3	...	...
,,	27	1	1	...	...	...	...	2	...	...	4	...	2		6	2	...	10	9	...	1
,,	28	...	...	...	...	2	...	2	...		1	...	...	...	1	...	...	3	6	...	1
Total for Month		3	4	1	4	3	7	22	5	33	7	1	11	...	57	+7 (34 died)	...	126	98	3	25

(7) ADMISSIONS INTO HARBIN PLAGUE HOSPITAL.

Date		From Railway Area.							From Fuchiatien.							From Wagons	From Elsewhere.	Total Admiss.	Plague Deaths	Non-plague Deaths.	Alive.
		I	II	III	IV	V	Etc.	Total	I	II	III	IV	V	Etc	Total						
March	1	...	...	...	...	...	..	...	...	...	...	...	1	...	1	3	...	4	4	...	...
,,	2	...	...	...	...	...	1	1		...	...	...	2	1	3	0	...	4	7	...	2
,,	3	...	...	...	...	...	...	...	...	1	...	..	1	...	2	1	...	3	2	...	...
,,	4	...	...	...	...	...	...	...	...	1	...	1	3	...	5	1	...	6	6	...	...
,,	5	1	...	...	...	...	...	1	...	5	2	...	3	...	10	0	...	11	13	1	...
,,	6	...	1	...	...	...	...	1	2	7	1	...	2	..	12	2	...	15	13	...	2
,,	7	...	...	...	...	...	4	4	2	..	...	...	1	...	3	2	...	9	6	...	3
,,	8	...	...	...	...	...	..	...	1	5	...	...	4	...	10	1	...	11	3	1	...
,,	9	...	...	...	...	2	1	3	1	1	7	...	1	...	10	8	...	21	20	...	1
,,	10	...	1	...	1	...	...	2	2	...	1	...	...	...	3	9	...	14	17	...	...
,,	11	...	1	...	...	...	...	1	1	2	...	...	5	...	8	2	...	11	12	...	...
,,	12	2	...	...	...	...	2	4	3	3	...	...	...	...	6	1	...	11	9	2	...
,,	13	...	2	...	...	...	3	5	4	5	..	1	2		12	1	...	18	9	...	1
,,	14	2	...	...	...	...	...	2	2	4	1	..	5	..	11	2	...	15	18	...	...
,,	15	4	...	...	...	...	2	6	1	2	1	1	4	...	9	2	3	20	10	...	5
,,	16	...	...	...	2	1	1	4	1	4	1	...	5	...	11	7	2	24	21	...	2
,,	17	1	...	...	1	...	1	3	2	3	...	...	3	...	8	5	7	23	19	...	2
,,	18	1	2	...	...	...	1	4	4	2	3	...	2	...	11	9	...	24	17	1	2
,,	19	...	...	2	1	2	...	5	8	3	2		8	...	21	6	2	34	32	...	...
,,	20	...	2	...	3	2	1	8	1	4	...	2	1	...	8	6	5	27	28	...	...
,,	21	1	...	...	...	2	1	4	4	3	1	...	2	...	10	6	...	20	28	...	5
,,	22	...	...	1	3	...	...	4	2	5	1	5	4	...	17	6	1	28	26	1	...
,,	23	...	...	...	1	...	...	1	3	1	...	1	5	...	10	7	...	18	16	...	1
,,	24	1	1	...	1	...	...	3	1	9	3	2	2	...	17	1	5	26	18	...	3
,,	25	4	1	...	...	...	...	5	4	5	1	1	10	...	21	6	...	32	18	...	...
,,	26	...	2	...	3	...	1	6	6	2	2	...	13	4	27	2	...	35	39	...	2
,,	27	...	...	...	2	6	...	8	2	5	..	1	9	2	19	4	3	34	45	...	1
,,	28	...	...	1	...	2	...	3	3	13	1	...	15	...	32	4	...	39	35	...	1
,,	29	...	1	4	1	11	...	17	2	3	4	2	7	...	18	4	...	39	29	...	4
,,	30	...	1	2	...	3	6	12	2	8	8	...	5	...	23	1	4	40	38	...	2
,,	31	1	...	...	2	...	...	3	7	...	...	...	1	1	9	9	5	26	39	...	...
Total for month		18	15	10	21	31	25	120	71	105	40	17	126	8	367	118 92 (died)	37	642	597	6	39

(8) ADMISSIONS INTO HARBIN PLAGUE HOSPITAL.

Date		From Railway Area.							From Fuchiatien.							From Wagons.	From Elsewhere.	Total Admiss.	Plague Deaths.	Non-plague Deaths.	Alive.
		I	II	III	IV	V	Etc.	Total	I	II	III	VI	V	Etc.	Total						
April	1	3	6	1	1	...	...	11	3	7	...	...	10	...	20	6	3	40	37	...	..
″	2	...	...	...	...	...	10	10	1	6	10	..	2	2	21	7	3	41	29	...	...
″	3	...	...	1	...	1	2	4	10	1	...	...	4	...	15	3	6	28	49	...	1
″	4	1	1	...	...	5	...	7	8	3	2	2	6	...	21	4	...	32	34	..	...
″	5	1	...	2	...	...	...	3	5	1	2	...	8	...	16	1	8	28	29	...	3
″	6	1	...	1	...	1	1	4	13	7	4	1	11	...	36	1		41	27	...	4
″	7	...	...	...	..	...	...	...	8	3	2	...	9	...	23	5	3	31	34	...	5
″	8	5	2	...	...	...	5	12	16	9	4	...	7	...	36	5	...	53	34	1	2
″	9	4	3	1	...	...	...	8	10	1	1	2	4	...	18	2	7	35	33	...	3
″	10	1	1	...	...	...	3	5	5	2	2	...	1	...	10		7	22	40	...	5
″	11	1	...	...	...	4	5	10	5	9	...	...	6	...	20	3	...	33	20	...	3
″	12	...	...	1	4	...	1	6	4	4	1	...	7		16	1	12	35	25	...	...
″	13	4	...	...	1	...	...	5	2	1	1	2	3	...	9	1	6	21	29	1	...
″	14	2	...	...	...	...	...	2	1	...	...	2	1	...	4	2	3	11	18	...	1
″	15	1	...	...	...	6	...	7	8	1	...	...	1	...	10	...	5	22	6	...	...
″	16	3	...	1	1	1	...	6	1	1	...	...	3	...	5	1	3	15	19	...	5
″	17	1	1	...	2	...	1	5	1	1	...	...	4	...	6	4	...	15	18	...	...
″	18	...	...	...	3	3	...	6	...	...	...	...	4	...	4	...	12	22	13	...	2
″	19	...	...	...	...	1	...	1	...	1	5	...	7	...	13	1	7	22	12	...	1
″	20	1	4	...	1	1	...	7	5	2	1	1	3	...	12	2	6	27	19	...	7
″	21	...	2	...	...	...	...	2	6	2	...	...	4	...	12	1	...	15	22	2	...
″	22	1	...	1	...	...	...	2	2	3	...	...	3	...	8	1	3	14	14	...	...
″	23	...	...	...	1	...	...	1	1	1	1	...	3	...	6	2	5	14	10	...	...
″	24	...	1	...	1	...	...	2	...	...	1	...	5	...	6	...	6	14	13	...	...
″	25	...	...	...	...	...	1	1	2	1	...	...	1	...	4	3	3	11	5	...	...
″	26	1	...	...	1	2	...	4	...	1	2	...	1	...	4	...	2	10	5	...	...
″	27	...	...	...	1	...	...	1	...	...	...	...	...	...	...	1	2	4	7	1	...
″	28	...	...	...	...	...	...	...	...	...	...	...	...	...		...	1	1	4	...	2
″	29	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	2	3	1	..	5
″	30	...	1	...	...	...		1	...	...	...	...	...	...	...	...	2	3	3	..	...
Total for month		31	22	9	17	25	29	133	118	69	39	10	118	2	356	57 (47 died)	117	663	609	5	49

(9) ADMISSIONS INTO HARBIN PLAGUE HOSPITAL.

Date		FROM RAILWAY AREA							FROM FUCHIATIEN.							From Wagons	From Elsewhere	Total Admissions	Plague Deaths.	Non-Plague Deaths.	Alive.
		I	II	III	IV	V	Etc.	Total	I	II	III	IV	V	Etc.	Total						
May	1	1	...	...	...	...	...	1	...	1	...	...	...	...	1	1	...	3	2		
″	2	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	2	...	...
″	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
″	4	...	...	...	...	...	...	...	...	...	...	1	...	...	1	2	1	4	...	...	1
″	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
″	6	...	...	...	...	...	...	...	...	...	3	...	...		3	...	...	3	...	...	...
″	7	...	...		...	...	1	1	...	...	1	1	...	...	2	1	...	4	...	...	...
″	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	9	...	...	...			1	1	...	...	...	...	...	...	...	...	...	1	...	2	2
″	10	...	...	...	...	...	1	1	...	...	1	...		1	2	...	...	3	...	1	...
″	11	...	...	...	...	...	1	1	2	...	...	...	...	...	2	1	...	4	...	...	...
″	12	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	1	...
″	13	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	1	1	1	1
″	14	...	...	...	...	...	...	...		...	...		...	...	...	...	...	...	...	...	1
″	15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
″	16	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...
″	17	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
″	18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	19	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	1	...	...	1
″	20	...	...	...	...	...	1	1	...	...	...	...	2	...	2	...	...	1	...	...	...
″	21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	1	...
″	22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
″	25	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...
″	36	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...
″	27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
″	31	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...
Total		1	1	...	...	...	7	6	2	1	5	2	2	1	13	5 (All died)	1	28	6	8	12

(10) ISOLATION WAGONS.

CONTACTS FOR FEBRUARY, 1921.

Date 日期	Fuchiatien 傅家甸	Pristan 道裡	Sungari B 江岸	Machiakow 馬家溝	New Town 南崗	N. Sungari 北江	Train No. 22 由長春來第二十二號車	Plague Hospital 防疫醫院	Station 車站	Pa Li Chan 八里站	Kang Sia Po 崗下坡	Pinlientzu 偏臉子	Kushangtun 顧鄉屯	Total 總數
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	41	...	...	...	...	...	...	41
4	...	...	...	6	...	...	...	...	...	...	...	...	...	6
5	3	...	...	21	...	...	...	...	...	...	...	...	...	24
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7	3	...	...	...	...	...	...	...	...	...	...	...	...	3
8	...	...	...	...	...	...	...	16	...	...	...	...	...	16
9	...	...	...	...	...	...	...	...	19	...	...	...	...	19
10	1	...	9	...	...	...	...	...	...	...	...	...	...	10
11	...	...	...	1	4	...	...	1	...	...	...	...	...	6
12	...	...	...	...	1	3	...	...	...	...	...	...	...	4
13	1	...	...	4	11	78	...	26	...	1	...	...	...	119
14	17	2	...	...	...	...	...	...	...	...	...	...	...	19
15	53	13	...	...	...	...	...	...	...	...	...	...	...	66
16	1	...	...	...	...	...	...	...	...	...	...	...	...	1
17	24	...	...	16	...	...	...	...	...	...	1	...	...	41
18	8	...	...	...	...	...	...	1	...	...	...	...	...	9
19	...	16	...	...	...	...	...	31	...	...	...	...	...	47
20	3	2	...	...	...	...	...	...	...	...	...	...	...	5
21	1	...	...	...	...	...	...	1	...	...	...	...	...	2
22	13	...	...	...	1	...	...	2	...	...	...	...	...	16
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	14	...	...	...	...	...	...	...	...	...	...	...	...	14
25	15	1	...	8	...	...	...	...	2	...	...	...	2	28
26	8	...	...	...	...	...	...	...	...	...	...	...	4	12
27	5	1	...	2	...	...	...	1	...	...	...	...	...	9
28	4	...	...	...	...	...	...	22	...	...	...	...	...	26
	174	37	9	58	17	81	41	101	21	1	1	0	9	547

SICK SENT TO HOSPITAL, (FEB.)

Date. 日期	Fuchiatien 傅家甸	Sungari Bank. 沿江	Machiakow 馬家溝	Train No. 22 由長春二十二號車	Plague Hospital 防疫醫院	Total. 總數
1	...	...	...	...	...	...
2	...	...	...	...	...	...
3	...	...	...	...	...	...
4	...	...	...	...	...	...
5	...	...	1	...	...	1
6	...	...	4	...	...	4
7	...	...	1	1	...	2
8	...	...	...	...	...	...
9	...	...	1	...	1	2
10	...	...	...	...	...	...
11	...	...	...	...	1	1
12	...	...	...	...	...	...
13	...	...	...	...	...	...
14	1	2	...	...	...	3
15	1	...	4	...	...	5
16	1	...	...	...	...	1
17	...	1	...	...	1	2
18	...	...	...	...	1	1
19	2	...	2	...	...	4
20	8	...	...	...	2	10
21	1	...	...	...	1	2
22	2	...	.	...	...	2
23	2	...	...	...	...	2
24	1	...	...	...	...	1
25	1	...	...	...	...	1
26	1	...	...	...	...	1
27	1	..	...	...	...	2
28		...	...	...	...	...
	22	3	14	1	7	47 of these 34 died

34 Plague and 13 Non-Plague cases.

(11) ISOLATION WAGONS.

Contacts for March, 1921

Date 日期	Fuchiatien 傅家甸	Middle Sungari 江心	New Town 南崗	Machiakow 馬家溝	Fuchiatien Plague Hosp. 防疫醫院	Pristan 道裡	N. Sungari 江北	Sungari B. 江岸	Pinlientzu 偏臉子	Station 車站	Shangkang 上崗	Rly. Dept. 火地包	Kushangtun 顧鄉屯	Chenyuho 眞玉河	Total 總數
1	4	...	...	...	...	...	...	...	...	...	...	...	...	...	4
2	4	...	...	...	...	...	...	...	...	...	...	...	...	...	4
3	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
4	7	...	...	...	...	...	...	...	...	...	...	...	...	...	7
5	70	...	...	...	...	...	...	...	...	...	...	...	...	...	70
6	16	...	5	...	...	...	1	...	...	...	...	...	...	...	22
7	20	...	...	...	...	1	...	...	...	...	...	...	...	...	21
8	2	...	...	...	3	...	39	...	...	...	...	...	...	...	44
9	24	2	...	...	...	...	...	...	...	...	...	...	...	...	26
10	20	...	...	...	8	...	...	...	5	1	...	...	...	...	29
11	8	...	...	...	...	...	...	...	...	1	...	...	...	...	9
12	33	...	...	...	...	...	...	...	...	...	...	...	...	...	33
13	6	...	1	...	...	...	...	...	...	...	...	...	...	...	7
14	8	...	...	...	...	1	...	...	...	...	...	...	...	...	9
15	29	...	...	...	1	7	17	...	...	2	...	...	...	...	56
16	27	...	...	...	3	17	8	...	...	3	...	...	...	...	58
17	3	...	...	...	1	2	...	...	4	...	...	...	...	...	10
18	1	...	...	9	...	...	12	...	...	...	...	...	...	...	22
16	8	...	1	...	...	6	...	5	...	...	7	...	...	...	27
20	37	...	...	...	...	20	...	...	...	...	...	...	...	...	57
21	5	...	...	...	...	1	...	...	...	...	...	...	...	...	6
22	11	...	...	1	...	...	...	...	...	...	...	1	...	...	13
23	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1
24	34	...	1	2	...	...	...	...	...	...	...	...	...	...	37
25	28	...	1	...	3	29	...	...	...	...	...	...	...	1	62
26	43	...	3	...	...	...	...	...	9	...	...	...	...	...	55
27	12	...	6	...	2	1	...	...	...	4	...	...	...	...	25
28	18	...	2	...	2	37	...	...	2	3	...	...	28	...	92
29	18	...	...	...	2	11	2	...	...	3	...	...	11	...	66
30	22	...	...	...	...	...	...	...	...	...	...	...	2	...	24
31	28	...	...	4	...	...	...	...	...	...	...	...	...	...	32
	548	2	20	17	20	133	79	5	20	17	7	1	41	1	911

Sick Sent to Hospital (March).

Date 日期	Fuchiatien 傅家甸	Machiakow 馬家溝	Fuchiatien Plague Hosp. 防疫醫院	Pristan 道裡	N. Sungari 江北	Sungrai B. 江沿	Pinlientzu 偏臉子	Rly. Dept. 地包	Station 車站	Shangkung 上崗	Chenyuho 眞玉河	Kushangtun 顧鄉屯	Total 總數
1	1	...	...	...	...	...	...	...	...	...	...	...	1
2	...	...	...	...	...	...	...	...	...	...	...	...	...
3	1	...	...	...	...	...	...	...	...	...	...	...	1
4	...	...	...	1	...	...	...	...	...	...	...	...	1
5	...	...	...	...	...	...	...	...	...	...	...	...	...
6	2	...	...	...	...	...	...	...	...	...	...	...	2
7	2	...	...	...	...	...	...	...	...	...	...	...	2
8	1	...	...	...	...	...	...	...	...	...	...	...	1
9	2	...	...	...	6	...	...	...	...	...	...	...	8
10	2	...	3	...	3	...	1	...	...	...	...	...	9
11	1	...	...	...	1	...	...	...	...	...	...	...	2
12	...	...	...	...	1	...	...	...	...	...	...	...	1
13	1	...	...	...	...	...	...	...	...	...	...	...	1
14	2	...	...	...	...	...	...	...	...	...	...	...	2
15	1	...	...	...	...	...	...	1	...	...	...	...	2
16	4	...	...	1	2	...	...	...	...	...	...	...	7
17	1	...	...	...	1	...	...	...	2	...	...	...	4
18	5	...	1	...	3	...	...	...	...	...	...	...	9
19	2	1	...	1	1	...	1	...	...	...	...	...	6
20	2	2	...	1	...	1	...	...	...	...	...	...	6
21	3	...	1	1	1	...	...	...	...	...	...	...	6
22	4	1	...	...	1	...	...	...	...	...	...	...	6
23	3	...	...	...	...	...	...	...	...	4	...	...	7
24	1	...	...	...	...	...	...	...	...	...	...	...	1
25	5	...	...	...	...	...	...	...	...	...	1	...	6
29	2	...	...	...	...	...	...	...	...	...	...	...	2
27	3	1	...	...	...	...	...	...	...	...	...	...	4
28	2	...	1	...	...	...	...	...	...	...	...	...	3
29	4	...	...	...	...	...	...	...	...	...	...	1	5
30	1	...	...	...	...	...	...	...	...	...	...	...	1
31	5	...	...	2	...	...	...	...	1	...	...	2	10
	63	5	6	7	20	1	2	1	3	4	1	8	118

92 Plague and 26 Non-Plague cases.

(12) ISOLATION WAGONS.

Contacts for April, 1921.

Date 日期	Fuchiatien 傅家甸	Middle Sungari 江心	New Town 南崗	Machiakow 馬家溝	Fuchiatien Plague Hosp. 防疫醫院	Pristan 道裡	N. Sungari 江北	Sungari River 江岸	Pinlientzu 偏臉子	Station 車站	Lahantun 拉濱屯	Shangkang 上崗	Rly. Drpt. 火地包	Kushangtun 顧鄉屯	Chenyuho 眞王河	Total 總數
1	...	...	1	1	...	...	7	...	...	...	...	...	...	...	...	9
2	3	...	...	...	1	28	...	...	...	...	...	...	...	...	...	32
3	2	...	...	4	1	...	...	...	...	...	...	...	...	54	...	61
4	...	...	3	...	1	6	...	...	...	...	...	...	...	...	...	10
5	...	...	8	...	2	18	...	...	...	...	...	...	...	2	...	30
6	...	...	...	...	2	2	...	...	...	...	...	...	...	...	...	4
7	1	...	...	3	1	23	...	2	...	...	...	...	...	...	...	30
8	...	...	...	...	...	1	...	...	...	...	...	27	...	...	...	28
9	30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30
10	5	...	4	...	1	23	...	...	...	...	...	...	...	12	...	45
11	17	...	...	3	4	14	...	...	...	...	...	...	...	3	...	41
12	8	...	...	...	1	4	...	...	...	...	5	...	...	...	...	18
13	1	...	...	...	...	30	...	...	...	...	...	...	...	...	...	31
14	2	...	...	...	...	10	...	...	...	...	...	...	...	...	...	12
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0
16	1	...	...	...	...	...	...	...	...	...	6	...	...	5	...	12
17	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
18	6	...	...	...	...	1	...	...	...	...	26	...	...	...	...	33
19	3	...	...	2	1	1	...	...	...	...	...	...	...	...	4	11
20	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
21	7	...	...	...	2	1	...	...	...	...	...	...	...	...	...	10
22	2	...	...	...	...	2	...	...	...	...	...	...	...	...	...	4
23	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6
24	2	...	...	2	...	...	...	...	...	...	...	...	...	...	...	4
25	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
26	5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5
27	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8
28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0
29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0
30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0
	120	0	16	15	17	164	7	2	0	0	37	27	0	76	4	485

Sick Sent to Hospital (April).

Date 日期	Funchiatien 傅家甸	Machiakow 馬家溝	Fuchiatien Plague Hosp. 防疫醫院	Pristan 道裡	N. Sungari 江北	Sungari B. 江沿	Pinlientzu 偏臉子	Rly. Dept. 地包	Station 車站	Shangkang 上崗	Chenyuho 眞王河	Kushangtun 顧鄉屯	Total 總數
1	...	...	3	...	...	...	...	...	...	...	...	3	6
2	...	...	4	...	...	...	1	...	...	...	...	2	7
3	2	...	1	...	...	...	...	...	...	...	...	...	3
4	...	...	3	...	1	...	...	...	...	...	...	...	4
5	1	...	...	...	...	...	...	...	...	...	...	...	1
6	1	...	...	...	...	...	...	...	...	...	...	...	1
7	1	4	...	...	...	...	...	...	...	...	...	...	5
8	1	1	...	2	1	...	...	...	...	...	...	...	5
9	...	...	1	1	...	...	...	...	...	...	...	...	2
10	...	...	...	...	...	...	...	...	...	...	...	...	0
11	...	...	...	...	...	...	...	...	...	1	...	2	3
12	...	1	...	...	...	...	...	...	...	...	...	...	1
13	1	...	...	...	...	...	...	...	...	...	...	...	1
14	1	...	1	...	...	...	...	...	...	...	...	...	2
15	...	...	...	...	...	...	...	...	...	...	...	...	0
16	...	...	1	...	...	...	...	...	...	...	...	...	1
17	...	...	...	1	...	...	2	...	...	1	...	...	4
18	...	...	...	...	...	...	...	...	...	...	...	...	0
19	...	...	...	1	...	...	...	...	...	...	...	...	1
20	...	...	...	2	...	...	...	...	...	...	...	...	2
21	...	...	...	1	...	...	...	...	...	...	...	...	1
22	...	...	...	...	...	...	1	...	...	...	...	...	1
23	...	1	...	1	...	...	...	...	...	...	...	...	2
24	...	...	...	...	...	...	...	...	...	...	...	...	0
25	...	...	3	...	...	...	...	...	...	...	...	...	3
26	...	...	...	...	...	...	...	...	...	...	...	...	0
27	...	...	1	...	...	...	...	...	...	...	...	...	1
28	...	...	...	...	...	...	...	...	...	...	...	...	0
29	...	...	...	...	...	...	...	...	...	...	...	...	0
30	...	...	...	...	...	...	...	...	...	...	...	...	0
	8	7	18	9	2	0	4	0	0	2	0	7	57

47 Plague and 10 Non-Plague cases.

(13) ISOLATION WAGONS

CONTACTS FOR MAY, 1921.										
Date.	Fuchiatien	Pristan	Sungari Bank	Machiakow	New Town	N. Sungari	Train No. 22	Plague Hospital	Station	Total
1	...	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...	...
5	3	...	...	...	...	...	...	...	...	3
6	...	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...	...
8	9	...	...	...	...	...	...	...	...	9
9	...	...	...	...	...	...	...	...	...	...
10	5	...	...	...	...	...	...	...	10	15
11	4	...	...	...	...	...	...	...	...	4
12	...	...	...	...	...	...	...	...	...	...
13	8	...	...	...	...	...	...	...	...	8
14	...	...	...	...	...	...	...	...	...	...
15	13	...	...	...	...	...	...	...	...	13
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...
18	2	...	...	7	...	...	...	...	...	9
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
21	1	...	...	...	...	...	...	...	...	1
22	...	6	...	...	...	...	2	...	...	8
23	3	...	...	...	...	...	...	...	...	3
24	4	...	...	...	...	...	1	...	...	5
25	...	...	...	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...	...	...	...
27	...	...		...	...	...	...	...	...	...
28	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...
	52	6		7			3		10	78

SICK SENT TO HOSPITAL, (MAY)							
Date.	Fuchiatien	Sungari Bank	Machiakow	Train No. 22	Plague Hospital	Pristan	Total
1	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...
7	...	...	...	...	...		...
8	1	...	...	...	...	...	1
9	...	...	...	...	...	...	...
10	1	...	...	...	...	...	1
11	...	...	...	...		...	...
12	1	...	...	...	...	...	1
13	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...
15	...	...	...	...	...		...
16	...	...	...	...	...		...
17	...	...		...	...	...	...
18	...	...	...	...	...		...
19	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...
21	...	...		...	...		...
22	...	...	...	...	...	2	2
23	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...
25	...	...	...	...		...	...
26	...	...	...	...	...		...
27	...	...	...	...		...	...
28	...	...	...	...	...	...	...
29	...	...	...	...	...	...	...
	3					2	*5

(*all died of plague)

Meteorological Readings, Harbin.

哈爾濱氣候報告表

(14) JANUARY 1921.

一九二一年正月

Date 日期	BAROMETER mm. 風雨表				THERMOMETER Centig. 寒暑表攝氏					
	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	Max. 最大度數	Min. 最小度數
1	757.6	756 4	761.5	758.5	-16.4	-16.9	-25.4	-19.6	-14.6	-25 6
2	63.2	62.5	60.4	62.0	-28.9	-20 2	-26.7	-25.3	-18.8	-30.0
3	57.4	56.8	56.3	56.8	-28.0	-19.0	-20.9	-22.6	-17.5	-28.7
4	56.3	55.6	54.8	55.6	-24.6	-15.6	-17.9	-19.4	-14.1	-25.7
5	55.7	56.8	57.7	56.7	-26.0	-17.7	-24.2	-22.6	-16.4	-27.2
6	57.8	58.1	60.4	53.8	-25.9	-15.8	-22.0	-21.2	-15.1	-27.1
7	62.3	63.5	65.1	63.6	-30.5	-20.6	-25.4	-25.5	-19.6	-30.7
8	65.6	65.2	63.3	64.7	-32.1	-19.4	-25.4	-25.6	-18.6	-32.8
9	59.3	57.5	56.9	57.9	-22 6	-15.6	-20.8	-19.7	-14.4	-25 8
10	53.2	50.2	49.1	50.8	-17.2	-12.0	-18.6	-15.9	-11.8	-21.6
11	51.6	53.1	55.9	53.5	-25.8	-18.6	-22.9	-22.4	-16.9	-26.6
12	55.9	57.1	57.4	56.8	-27.8	-17.5	-22.6	-22.6	-15.8	-29.4
13	56.5	56.7	58.1	57.1	-23.8	-14.8	-24.5	-21 0	-13.8	-25.6
14	58.0	56.8	54.2	56.3	-29.2	-17.2	-18.0	-21.5	-14.5	-30.1
15	48.7	48.7	48 2	48.5	-15.9	-8.9	-10.9	-11.9	-7.9	-19 3
16	51.3	53.0	57.5	53.9	-16.1	-4.6	-15.6	-12.1	-4.0	-16.8
17	60.1	60.2	57.2	59.2	-23.0	-7.1	-15.8	-15.3	-6.3	-24.2
18	51.0	47.4	49.0	49.1	-14.5	-3.4	-10.2	-9.4	-2.3	-16 8
19	50.0	47.8	44.4	47.4	-19.6	-6.6	-11.2	-12.5	-5.3	-20.6
20	40.6	40.8	44.0	41.8	-14.2	-8.1	-12.0	-11.4	-7.4	-15.2
21	46.3	47.0	44.7	46.0	-21.4	-12.4	-15 8	-16.5	-11.1	-21.9
22	42.3	44.2	44.6	43.7	-19.2	-11.6	-18.5	-16.4	-10.9	-19.8
23	42.7	44.9	45.0	44.2	-11.6	-5.2	-12.6	-9.8	-3.9	-18.5
24	50.3	50.9	50.9	50.7	-18.4	-6.7	-8.7	-11.3	-2.9	-19.4
25	52.2	53.7	56.7	54.2	-15.2	-13 6	-19.2	-16.0	-8.7	-19.2
26	61.1	62.0	60.0	61.0	-29.2	-17.0	-21.6	-22.9	-15.1	-29.6
27	55.3	52.6	50.9	52.9	-22.7	-8.6	-13.0	-14.8	-6.5	-23.5
28	52.7	51.9	51.0	51.9	-21.4	-8.5	-15.5	-15.1	-6 1	-22.3
29	51.3	51.6	49.3	50.7	-17.4	-9.2	-11.0	-12.5	-8.6	-18.0
30	47.9	44.4	44.1	45.5	-19.4	-5.2	-8.2	-10.9	-3.5	-19.6
31	49.2	49.9	48.7	49 3	-16.0	-3.4	-8.3	-9.2	-3 9	-16.5
Average	753.7	753.5	753.5	753.6	-21.7	-12.3	-17.3	-17.2	-10.8	-23.5

⟨15⟩ FEBRUARY 1921.

一九二一年二月

Date 日期	BAROMETER mm. 風雨表				THERMOMETER Centig. 寒暑表攝氏					
	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	Max. 最大度數	Min. 最小度數
1	746.8	746.9	754.2	749.3	-15.5	-10 7	-15.9	-14.0	-7.6	-15.9
2	57.0	58.3	59.1	58.1	-23.2	-12.6	-17.6	-17.8	-11.1	-23.5
3	59.2	57.4	55.2	57 3	-26.8	-10.8	-19.4	-19.0	-9.4	-27.6
4	54.4	53 9	53.7	54.0	-27.4	-15.6	-20.5	-21.2	-12.7	-27.5
5	54.0	54.6	55.1	54.6	-24.8	-12.6	-17.6	-18.3	-9.6	-25.8
6	56.1	56 8	57.0	56.6	-22.9	-8.9	-16.3	-16.0	-7.1	-23.8
7	57 4	57.2	57.1	57.2	-20.4	-5.4	-14.4	-13 4	-4.0	-20.8
8	57.0	57.0	57.4	57.1	-19.0	-7.6	-15.0	-13.9	-6.0	-19.7
9	57.4	56.8	56.3	56.8	-21.3	-4.6	-12.4	-12.8	-2.5	-22.2
10	56.5	56.2	56.3	56.3	-20.6	-7.4	-11.9	-13.3	-5.5	-21.3
11	56.3	55 8	54.8	55.6	-20.9	-8.2	-15.4	-14.8	-6.0	-21.4
12	53.0	51.6	49.2	51.3	-19.5	-3.8	-10.0	-11.1	-3.0	-20.3
13	48.2	48.3	50.6	49.0	-18.8	-9.0	-13.0	-13.6	-5.5	-19.3
14	54.1	55.1	55.3	54.8	-21.4	-9.4	-13.4	-14.7	-7.4	-22.8
15	54 9	53.3	51.9	53.4	-18.9	-6.7	-10.8	-12.1	-5.5	-21.5
16	50.4	50.1	50.7	50.4	-20.4	-11.0	-14.4	-15.3	-7.9	-20.6
17	50.4	50.1	51.0	50.5	-23.2	-10.4	-17.4	-17.0	-9.1	-23.4
18	50.0	49.6	50.3	50.0	-23.5	-7.8	-11.6	-14.3	-7.3	-24.3
19	50 1	50.0	51.6	50.6	-18.6	-8.7	-15.0	-14.1	-7.5	-19.5
20	53.9	54.2	54.2	54.1	-22.0	-10.3	-14.9	-15.7	-9.3	-22.3
21	53.8	52.6	51.7	52.7	-23.8	-9.8	-14.2	-15.9	-8.5	-24.0
22	53.0	53.8	54.5	53.8	-23.0	-11.8	-15.9	-16.9	-10.1	-23.1
23	54.3	53.2	51 3	52.9	-24.2	-8.9	-16.0	-16.4	-6.8	-24.5
24	49.9	49.1	48.2	49.1	-20.4	-4.0	-13.9	-12.8	-2.5	-20.9
25	43.1	40.1	38.0	40.4	-8.0	-0.6	-1.2	-2.5	-2.3	-16.0
26	32.1	31.2	36.8	33.4	-0.2	-0.6	-9.1	-3.2	-2.8	-9.1
27	42.8	44.4	47.4	44.9	-11.0	-7.2	-12.0	-10.1	-6.5	-12.8
28	49.3	47.8	46 5	47.9	15.8	-6.3	-10.2	-10.8	-5.0	-17.5
Average	752.0	751.6	752.0	751.9	-19.8	-8.2	-13.8	-13.9	-6.4	-21 .1

〈16〉 MARCH 1921.

一九二一年三月

Date 日期	BAROMETER mm. 風雨表				THERMOMETER Centig. 寒暑表攝氏					
	7 a.m. 午前 七時	1 p.m. 午後 一時	9 p.m. 午後 九時	Mean 平均 度數	7 a.m. 前午 七時	1 p.m. 午後 一時	9 p.m. 午後 九時	Mean 平均 度數	Max. 最大 度數	Min. 最小 度數
1	747.8	748.4	749.8	748.7	−15.5	−6.2	−13.0	−11.6	−5.0	−15.7
2	50.9	51.0	49.8	50.6	−19.1	−7.6	−9.9	−12.2	−6.7	−19.4
3	45.9	46.6	48.5	47.0	−13.5	−6.9	−12.5	−11.0	−6.0	−14.4
4	48.8	48.3	48.6	48.6	−18.2	−4.2	−10.2	−10.9	−2.5	−18.5
5	48.4	47.8	47.5	47.9	−16.8	−1.0	−6.7	−8.2	−0.1	−17.4
6	48.8	49.6	50.3	49.6	−14.6	−2.6	−7.4	−8.2	−1.0	−14.9
7	48.3	47.3	46.9	47.5	−11.4	−2.1	−3.1	−4.1	−4.5	−11.8
8	47.2	47.7	51.2	48.7	−11.8	−3.0	−5.9	−4.9	−4.4	−12.7
9	53.5	54.0	54.4	54.0	−15.7	−2.0	−6.8	−8.2	−1.0	−15.9
10	52.9	50.2	50.2	51.1	−14.5	−1.9	−6.0	−7.5	−1.9	−15.6
11	51.9	52.6	52.6	52.4	−14.6	−3.2	−7.6	−8.5	−1.9	−15.5
12	53.1	52.1	52.4	52.5	−13.5	−4.8	−10.7	−9.7	−4.3	−13.9
13	49.9	47.4	47.9	48.4	−18.4	−5.4	−9.9	−11.2	−4.6	−18.6
14	47.6	47.5	49.7	48.3	−11.6	−6.1	−8.0	−8.6	−5.0	−12.3
15	51.1	51.0	50.2	50.8	−15.4	−2.8	−7.4	−8.5	−1.2	−16.3
16	49.4	47.6	47.0	48.0	−14.3	−0.4	−5.4	−6.7	−1.1	−15.6
17	46.2	45.7	46.3	46.1	−9.2	−0.8	−5.3	−4.6	−2.1	−10.0
18	48.4	48.7	48.2	48.4	−12.6	−2.2	−3.0	−4.5	−3.4	−14.2
19	45.5	41.6	39.7	42.3	−3.0	−4.1	−2.0	−0.3	−7.3	−4.4
20	38.2	36.4	39.2	37.9	−9.1	−1.8	−5.1	−5.3	−1.3	−10.0
21	42.9	43.1	45.1	43.7	−11.6	−0.6	−6.3	−5.8	−1.2	−13.0
22	47.0	47.5	48.5	47.7	−12.2	−0.0	−6.7	−6.3	−1.0	−13.7
23	50.5	52.0	54.1	52.2	−10.8	−2.5	−7.9	−7.1	−1.4	−13.4
24	56.1	55.2	54.7	55.3	−13.4	−0.7	−4.8	−6.3	−1.5	−14.7
25	54.6	53.9	53.8	54.1	−10.8	−1.4	−5.9	−5.1	−2.3	−13.1
26	53.1	51.9	52.7	52.6	−11.9	−1.1	−5.0	−5.3	−2.0	−13.8
27	53.0	51.9	51.7	52.2	−8.2	−0.6	−3.5	−3.7	−2.7	−13.6
28	51.5	50.8	50.0	50.8	−7.6	−4.4	−1.2	−1.5	−6.2	−11.0
29	47.9	46.6	47.7	47.4	−3.0	−10.2	−3.5	−3.6	−11.3	−5.6
30	50.6	50.7	50.9	50.7	−2.6	−8.4	−3.0	−2.9	−10.8	−4.3
31	50.0	47.7	47.7	48.5	−4.6	−3.5	−8.9	−5.7	−9.0	−0.1
Average	749.4	748.8	749.3	749.2	−11.6	−0.6	−5.5	−5.9	−3.7	−13.0

〈17〉 APRIL 1921.

一九二一年四月

Date 日期	BAROMETER mm. 風雨表				THERMOMETER Centig. 寒暑表攝氏					
	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	Max. 最大度數	Min. 最小度數
1	744.8	743.8	745.0	744.5	5.6	11.2	4.6	7.1	11.8	4.1
2	47.6	48.7	51.4	49.2	0.0	9.2	4.0	4.4	10.2	−1.3
3	50.3	48.7	47.6	48.9	−0.3	6.8	1.0	2.5	7.8	−1.5
4	47.7	47.0	47.3	47.3	−5.2	3.2	−0.8	−0.9	4.8	−6.1
5	48.9	50.3	51.6	50.3	−6.1	4.5	0.7	−0.3	5.5	−8.4
6	52.4	52.2	53.0	52.5	−4.6	4.1	−1.8	−0.8	4.8	−5.0
7	52.0	49.4	48.1	49,8	−6.4	4.2	−0.6	−0.9	6.2	−8.8
8	47.8	46.5	45.5	46.6	−2.9	8.0	3.1	2.7	10.1	−7.5
9	46.4	46.7	46.8	46.6	1.8	13.7	6.5	7.3	14.4	−1.2
10	46.2	44.7	44.8	45.2	5.6	15.0	6.1	8.9	15.5	3.1
11	43.0	42.2	42.4	42.5	3.0	8.2	7.7	6.3	15.0	2.3
12	41.7	38.5	37.4	39,2	4.4	19.0	14.3	12.6	20.7	−0.4
13	34.8	32.6	32.3	33.2	8.7	15.5	13.2	12.5	19.0	8.3
14	32.1	33.1	40.0	35.1	7.6	9.4	2.3	6.4	13.2	1.7
15	48.3	49.1	48.2	48.5	1.0	10.2	4.8	5.3	12.8	0.1
16	44.6	43.9	47.2	45.2	4.0	7.7	1.0	4.2	10.9	0.1
17	45.0	44.1	44.6	44.6	−0.2	8.8	2.2	3.6	9.3	−3.2
18	46.8	47.6	46.5	47.0	−2.0	9.4	7.4	4.9	11.5	−4.4
19	39.2	40.7	46.4	42.1	12.0	11.9	3.0	9.0	14.2	3.0
20	47.6	46.3	46.0	46.6	1.4	11.4	4.4	5.7	11.4	−1.8
21	42.8	41.1	45.1	43.0	4.2	14.2	5.7	8.0	14.2	−0.5
22	46.7	35.5	42.3	38.2	12.0	15.4	6.6	11.3	17.2	4.5
23	45.5	45.1	47.5	46.0	1.2	8.6	3.5	4.4	10.1	0.1
24	50.7	47.6	41.7	46.7	0.6	11.6	8.6	6.9	13.8	−4.7
25	38.0	41.5	46.1	41.9	9.8	11.5	5.2	8.8	14.1	5.0
26	50.0	50.5	50.1	50.2	2.0	11.8	6.2	6.7	12.7	−1.0
27	49.0	45.6	43.9	46.2	6.1	12.6	4.8	7.8	13.0	1.8
28	44.7	42.5	40.0	42.4	3.0	17.4	14.6	11.7	20.0	−2.9
29	45.0	44.6	45.8	45.1	7.8	12.0	7.7	9.2	14.8	6.5
30	50.0	50.6	51.9	50.8	3.9	14.2	8.2	8.8	15.7	2.1
Average	745.3	744.7	745.6	745.2	2.6	10.7	5.1	6.1	12.5	−0.5

〈18〉 MAY 1921.

一九二一年五月

Date 日期	BAROMETER mm. 風雨表				THERMOMETER Centig. 寒暑表攝氏					
	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	7 a.m. 午前七時	1 p.m. 午後一時	9 p.m. 午後九時	Mean 平均度數	Max. 最大度數	Min. 最小度數
1	751 9	748.5	747.2	749.2	7.0	19.1	12.9	13.0	20.8	0.1
2	48.5	46.6	45.2	46.8	8.6	22.0	16.0	15.5	23.3	2.9
3	43.6	41.8	43.4	42.9	13.6	24.3	15.6	17.8	25.1	9.0
4	47.8	48.1	49.1	48.3	11.0	17.1	13.4	13.8	19.1	9.0
5	49.8	47.2	44.7	47.2	9.4	22.6	18.6	16.9	24.5	2.5
6	42.8	38.9	37.1	39.6	16.8	25.8	19.4	20.7	26.7	13.3
7	40.4	41.2	38.6	40.1	9.6	16.2	13.6	13.1	19.4	7.6
8	31.2	35.8	39.9	35.6	5.2	8.3	6.2	6.6	14.0	3.5
9	44.5	43.1	36.9	41.5	6.0	18.4	18.2	14.2	21.6	0.7
10	39.4	42.9	45.3	42.5	12.5	6.2	6.2	8.3	18.4	5.9
11	48.1	45.0	42.4	45.2	3.2	11.3	6.8	7.1	13.6	1.6
12	40.5	38.2	36.5	38.4	7.6	16.6	12.9	12.4	18.6	0.9
13	34.4	37.0	41.9	37.8	9.5	10.7	8.8	9.7	13.1	6.6
14	45.0	44.9	44.0	44.6	7.3	17.5	13.8	12.9	19.6	3.7
15	44.3	42.3	40.7	42.4	15.4	27.4	22.4	21.7	29.4	9.5
16	41.2	42.8	48.1	44.0	18.4	22.5	12.0	17.6	23.3	12.0
17	48 9	46 8	42.8	46.2	9.8	22.8	18.8	17.1	24.5	8.2
18	41 3	39.3	38 4	39.7	15.2	23.2	17.2	18.5	24.6	11.0
19	40.0	40.9	41.7	40.9	10.8	18.0	11.8	13.5	20.6	9.3
20	44.0	44.4	42.8	43.7	12.2	19.6	15.0	15.6	22.7	5.0
21	43.5	42.2	41.3	42.3	15.6	24.2	17.6	19.1	25.7	8.1
22	42 4	41.6	41.6	41.9	16.4	26.9	18.2	20.5	27.6	10.3
23	43.7	43.0	42.9	43.2	16.8	28.1	21.2	22.0	29.7	11.2
24	44.3	42.5	41 4	42.7	18.7	30.4	24.4	24.5	31.1	10.7
25	44.6	43 2	42.4	43.4	12.1	13.8	11.9	12.6	24.4	10.5
26	41.5	40.2	40.2	40.6	11.4	19.0	15.6	15.3	21.1	9.5
27	42.1	41.6	40.9	41.5	11.0	18.4	15.5	15.0	20.2	6.8
28	42.0	41.0	40.1	41.0	16.2	24.8	19.0	20.0	27.5	10.1
29	40.6	40.8	44.5	42.0	18.5	24.8	15.4	19.6	25.2	14.5
30	47.1	46.0	45 7	46.3	11.6	22.4	12.4	15.5	23.5	7.2
31	46.2	47.4	48.5	47.4	11.0	13.0	10.8	11.6	14.7	9.3
Average	743.4	742.7	742.5	742.9	11.9	19.9	14.9	15.6	22.4	7.3

(19) PLAGUE MORTALITY IN FUCHIATIEN AND RAILWAY AREA, HARBIN.

	Date.	*Hospital.*	*City.*	*Railway Area.*	*Total.*
Feb.	1	1	0	0	1
	2	0	0	5	5
	3	0	0	1	1
	4	0	1	1	2
	5	0	0	0	0
	6	1	1	0	2
	7	4	3	0	7
	8	2	2	0	4
	9	8	0	4	12
	10	1	1	3	5
	11	2	0	2	4
	12	1	0	2	3
	13	5	14	1	16
	14	0	4	2	6
	15	5	3	2	10
	16	6	2	1	9
	17	4	11	1	16
	18	5	7	2	14
	19	6	7	3	16
	20	6	6	2	14
	21	9	2	0	11
	22	5	16	0	21
	23	3	7	2	12
	24	3	4	4	11
	25	3	4	1	8
	26	3	4	3	10
	27	9	3	0	12
	28	6	12	5	23
		98	110	47	255

	Date.	*Hospital.*	*City.*	*Railway Area.*	*Total.*	*Remarks.*
March	1	4	13	3	20	
	2	7	14	5	26	
	3	2	3	3	8	
	4	6	10	2	18	
	5	13	7	4	24	
	6	13	18	12	43	
	7	6	12	2	20	
	8	3	6	5	14	
	9	20	19	4	43	Warm
	10	17	11	6	34	Snow
	11	12	7	7	26	
	12	9	3	7	19	Cold & wind
	13	9	10	7	66	Snow T—5
	14	18	17	7(1 R.)	42	Snow
	15	10	14	19	43	
	16	21	19	19	59	Max 55° F.
	17	19	11	16	46	,, ,, ,,
	18	17	16	9	42	
	19	32	17	18	67	
	17	32	17	18	67	Snow
	20	28	19	17	64	,,
	21	28	23	19	70	
	22	26	15	6	47	
	23	16(1 K.)	16	4	36	
	24	18	17	23	58	
	29	29	20	24	73	
	25	18	26	26	70	
	26	39	23	29	91	
	27	45	21	22	88	
	28	35	30	29	94	
	30	38	26	20	84	Raining
	31	39	17	22	78	Morning raining
		597	480	396	1473	T 58° F.

(20) PLAGUE MORTALITY IN FUCHIATIEN AND RAILWAY AREA.

Date.		Hospital.	City.	Railway Area.	Total.	Remarks.
April	1	37	22	19	78	
	2	29	19	18	66	
	3	49	32	16	97	
	4	34	16	12	62	
	5	29	20	13	62	
	6	27	20	12	59	Fine weather. Matshed temple.
	7	34	16	25	75	,, ,,
	8	34	21	21	76	,, ,,
	9	33	23	17	73	,, ,,
	10	40	13	24	77	Very windy storm.
	11	20	17	10	47	
	12	25	14	13	52	Windy storm.
	13	29	25	8	62	,, ,,
	14	18	13	6	37	Rain.
	15	6	10	6	22	Bright weather. Movie begins
	16	19	12	7	38	
	17	18	11	7	36	Windy storm.
	18	13	13	17	43	Fine clear day. Movie.
	19	12	11	4	27	Windy storm.
	20	19	13	7	39	
	21	22	16	2	40	Dull, quite cold.
	22	14	9	9	32	Very windy storm.
	23	10	10	7	27	Bright though windy
	24	13	9	7	29	Bright day. running again.
	25	5	9	2	16	Windy.
	26	5	11	3	19	Bright day. Steamer start running again.
	27	7	5	0	12	
	28	4	7	3	14	Bright day.
	29	1	5	1	7	
	30	3	4	0	7	Bright day.
		609	426	296	1331	

Date.		Hospital.	City.	Railway Area.	Total.	
May	1	2	3	1	6	Windy
	2	2	1	2	5	,,
	3	0	5	0	5	
	4	0	4	0	4	
	5	0	0	0	0	
	6	0	3	0	3	Windy
	7	0	6	0	6	
	8	0	6	0	6	
	9	0	2	0	2	Cold
	10	0	2	0	2	Rain
	11	0	2	0	2	
	12	0	0	0	0	
	13	1	1	0	2	Rain
	14	0	3	0	3	
	15	0	0	0	0	
	16	0	3	0	3	
	17	0	3	0	3	
	18	0	0	0	0	
	19	0	6	0	6	
	20	0	1	0	1	
	21	1	1	0	2	
	22	0	1	0	1	
	23	0	2	0	2	
	24	0	0	0	0	
	25	0	0	0	0	
	26	0	0	0	0	
	27	0	0	0	0	
	28	0	0	0	0	
	29	0	0	0	0	
	30	0	0	0	0	
	31	0	0	0	0	
		6	55	3	64	

(21) PLAGUE DEATHS IN HARBIN AREA (Week by week.)

		Total.
Jan.	22-28	2
,,	29-4 Feb.	9
Feb.	5-11	34
,,	12-18	74
,,	19-25	93
,,	26-4 March	117
March	5-11	204
,,	12-18	277
,,	19-25	412
,,	26-1 April	652
April	2-8	431
,,	9-15	370
,,	16-22	255
,,	23-29	124
,,	30-6 May	30
May	7-13	20
,,	14-20	16
,,	21-27	5
,,	28	0
	Total ...	3,125

(23) PLAGUE DEATHS IN DALAINOR, Week by week.

		Total.
Jan.	2-8	40
,,	9-15	39
,,	16-22	111
,,	23-29	164
,,	30-5 Feb.	187
Feb.	6-12	171
,,	13-19	68
,,	20-26	80
,,	27-5 March	41
March	6-12	53
,,	13-19	17
,,	20-26	3
,,	27-2 April	9
April	3-9	10
,,	10-16	7
,,	17-23	0
,,	24-29	9
,,	30-6 May	19
May	7-13	33
,,	14-20	7
	Total ...	1,067

(22) PLAGUE DEATHS IN MANCHOULI, (Week by week.)

		Total.
Jan.	14-20	3
,,	21-27	10
,,	28-3 Feb.	30
Feb.	4-10	81
,,	11-17	147
,,	18-24	174
,,	25-3 March	108
March	4-10	110
,,	11-17	69
,,	18-24	33
,,	25-31	38
April	1-7 April	37
,,	8-14	52
,,	15-21	22
,,	22-28	21
,,	29-5 May	36
May	6-12	31
,,	13-19	34
,,	20-27	8
	Total ...	1,044

(24) PLAGUE DEATHS IN TSITSIHAR, Week by week.

Jan.	24-30	102
,,	31-6 Feb.	126
Feb.	7-13	142
,,	14-20	207
,,	21-27	170
,,	28-6 March	172
March	7-13	247
,,	14-20	186
,,	21-27	212
,,	28-3 April	144
April	4-10	8
,,	11-17	18
	Total ...	1,734

(25) PLAGUE DEATHS IN SHWANGCHENG.

Date	*Deaths*
April 1	1
2	1
3	3
4	4
5	0
6	0
7	1
8	1
9	21
10	6
11	4
12	2
13	3
14	2
15	2
	55

Revised.

21 March—31 April =143 (129 m; 14 f.)

Ages. 1—15= 4
16—30= 97
31—60= 42
143

(26) PLAGUE DEATHS IN ASHEHO.

Date	*Deaths.*
April 1	2
2	0
3	1
4	2
5	2
6	4
7	15
8	10
9	4
10	2
11	5
12	1
13	3
14	10
15	4
16	1
17	5
18	3
19	3
20	2
21	1
22	4
23	1
24	3
25	0
26	3
Total ...	91

PLAGUE DEATHS IN ASHEHO, (Weekly).

April 1-7	26
,, 8-14	35
,, 15-21	19
,, 22-28	11
Total ...	91

(27) PLAGUE DEATHS IN VLADIVOSTOK, Week by week.

			Total.
April	3-9		0
,,	10-16		15
,,	17-23		30
,,	24-30		52
May	1-7		77
,,	8-14		110
,,	15-21		82
,,	22-28		45
,,	29-4 June		33
June	5-11		14
,,	12-18		5
,,	19-25		18
,,	26-2 July		4
July	3-9		5
,,	10-16		6
,,	17-23		4
,,	24-30		0
Aug.	1-7	sick with bloody	1
,,	8-15	sputum corpses	5
		Totals ...	506

(28) PLAGUE DEATHS IN HAILAR, Week by week.

1920	Sept.	17-22	7
	Nov.	3	1
	Dec.	7-13	1
	,,	14-20	1
	,,	21-27	7
	,,	28-3 Jan. 1921	18
1921	Jan.	4-10	2
	,,	11-17	2
	,,	18-24	3
	,,	25-31	1
		Total ...	54

(29) PLAGUE DEATHS AT YU SHU HSIEN.

Date.		*M.*	*F.*	*Total.*
March	6	1	0	1
,,	7	1	0	1
,,	8	6	4	10
,,	9	3	3	6
,,	10	1	1	2
,,	11	2	0	2
,,	12	8	10	18
,,	13	17	16	33
,,	14	5	3	8
,,	15	2	1	3
,,	16	3	5	8
,,	17	1	4	5
,,	18	1	0	1
,,	19	5	4	9
,,	20	1	0	1
,,	21	0	0	0
,,	22	3	0	3
,,	23	3	2	5
,,	24	2	1	3
,,	25	0	2	2
,,	26	2	1	3
,,	27	2	1	3
,,	28	3	3	6
,,	29	2	1	3
,,	30	1	0	1
		75	62	137
April	8	1	0	1
,,	9	4	0	4
,,	10	0	0	0
,,	11	0	0	0
,,	12	0	0	0
,,	13	0	0	0
,,	14	0	0	0
,,	15	1	1	2
,,	16	1	1	2
,,	17	0	0	0
,,	18	4	1	5
,,	19	0	2	2
		11	5	16

Week by week.

		Total.
March	6-12	40
,,	13-19	67
,,	20-26	17
,,	27-2 April	13
April	3-8	1
,,	9-15	6
,,	16-22	9
	Total ...	153

(30) PLAGUE DEATHS IN CHANGCHUN.

1921	*M.*	*F.*	*Total.*
Feb. 20	1	0	1
,, 21	0	0	0
,, 22	0	0	0
,, 23	0	0	0
,, 24	1	0	1
,, 25	0	0	0
,, 26	0	0	0
,, 27	0	0	0
,, 28	0	0	0
	2	0	2
March 1	0	0	0
,, 2	0	0	0
,, 3	0	0	0
,, 4	1	0	1
,, 5	2	0	2
,, 6	0	0	0
,, 7	0	0	0
,, 8	0	0	0
,, 9	0	0	0
,, 10	1	0	0
,, 11	1	0	0
,, 12	1	0	0
,, 13	1	0	1
,, 14	1	0	1
,, 15	3	0	3
,, 16	2	3	5
,, 17	0	0	0
,, 18	9	3	12
,, 19	4	1	5
,, 20	2	0	2
,, 21	0	0	0
,, 22	2	0	2
,, 23	0	0	0
,, 24	1	0	1
,, 25	6	0	6
,, 26	0	0	0
,, 27	2	0	2
,, 28	6	0	6
,, 29	4	0	4
,, 30	8	2	10
,, 31	2	0	2
	59	9	68

April 1	0	0	0
,, 2	0	0	0
,, 3	3	0	3
,, 4	3	0	3
,, 5	0	0	0
,, 6	5	0	5
,, 7	1	0	1
,, 8	3	0	3
,, 9	5	0	5
,, 10	1	0	1
,, 11	2	0	2
,, 12	7	5	12
,, 13	4	0	4
,, 14	1	0	1
,, 15	2	0	2
,, 16	0	0	0
,, 17	2	0	2
,, 18	0	1	1
,, 19	0	0	0
,, 20	0	0	0
,, 21	0	0	0
,, 23	1	0	1
,, 22	0	0	0
	40	6	46

Week by week.

	Total
Feb. 20-26	2
,, 27-5 March	3
March 6-12	3
,, 13-19	27
,, 20-26	11
,, 27-2 April	24
April 3-9	20
,, 10-16	22
,, 17-23	4
	116

Changchun Mortality.

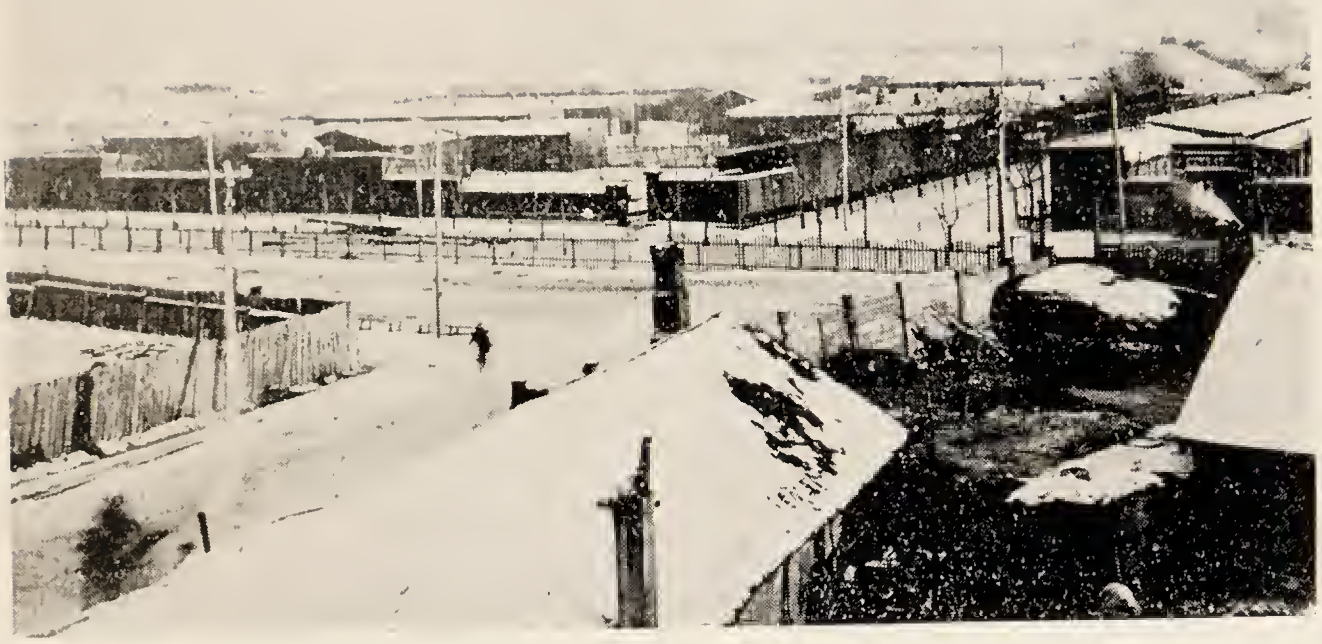
February 19-April 23, 1921.

Sex.

M	101	116
F	15	

Age.

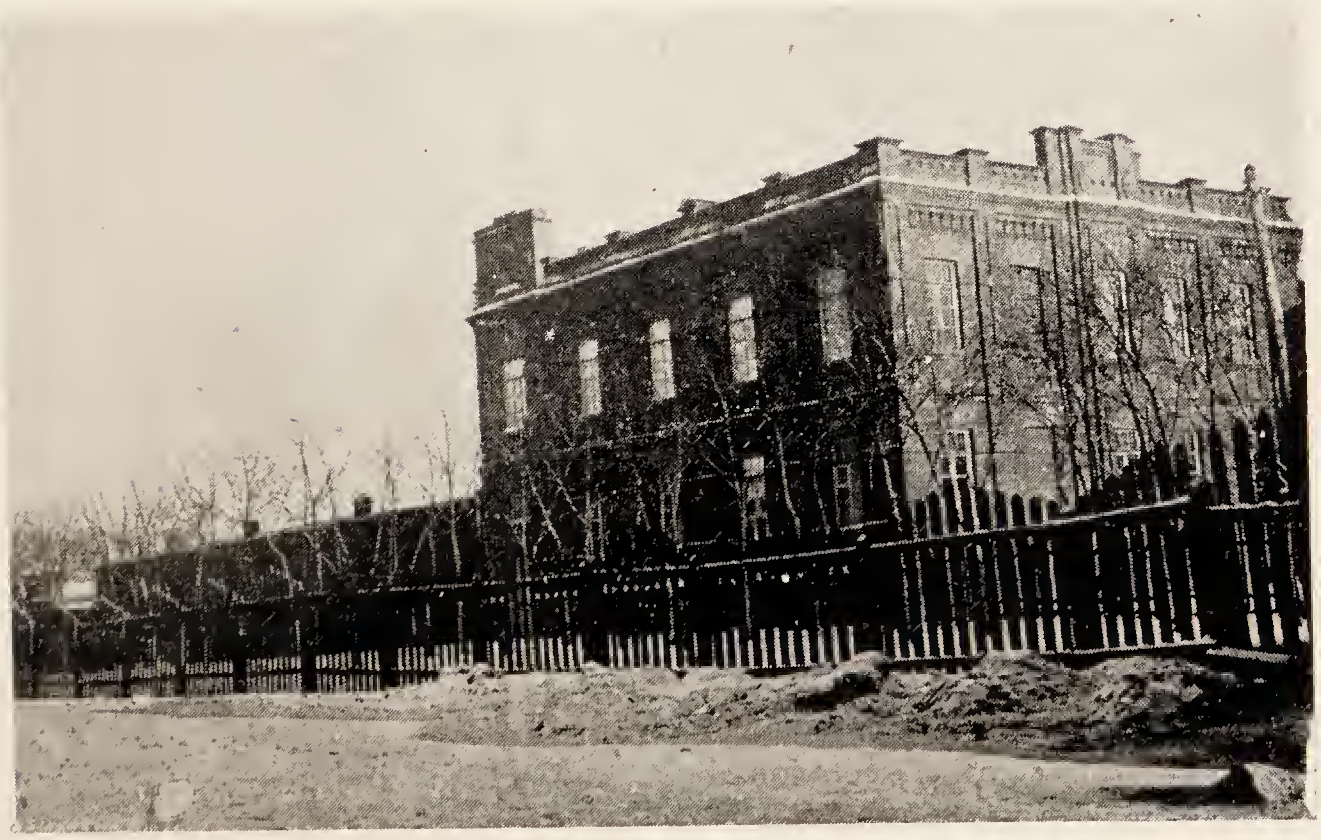
1—10	5	
11—20	8	
21—30	32	(1 Female)
31—40	36	(,,)
41—50	15	(,,)
51—60	2	
61—70	3	
	101	
Unknown	15	
Total	116	



Bird's eye view of east (plague) compound. Part of west (administrative) compound also shown.

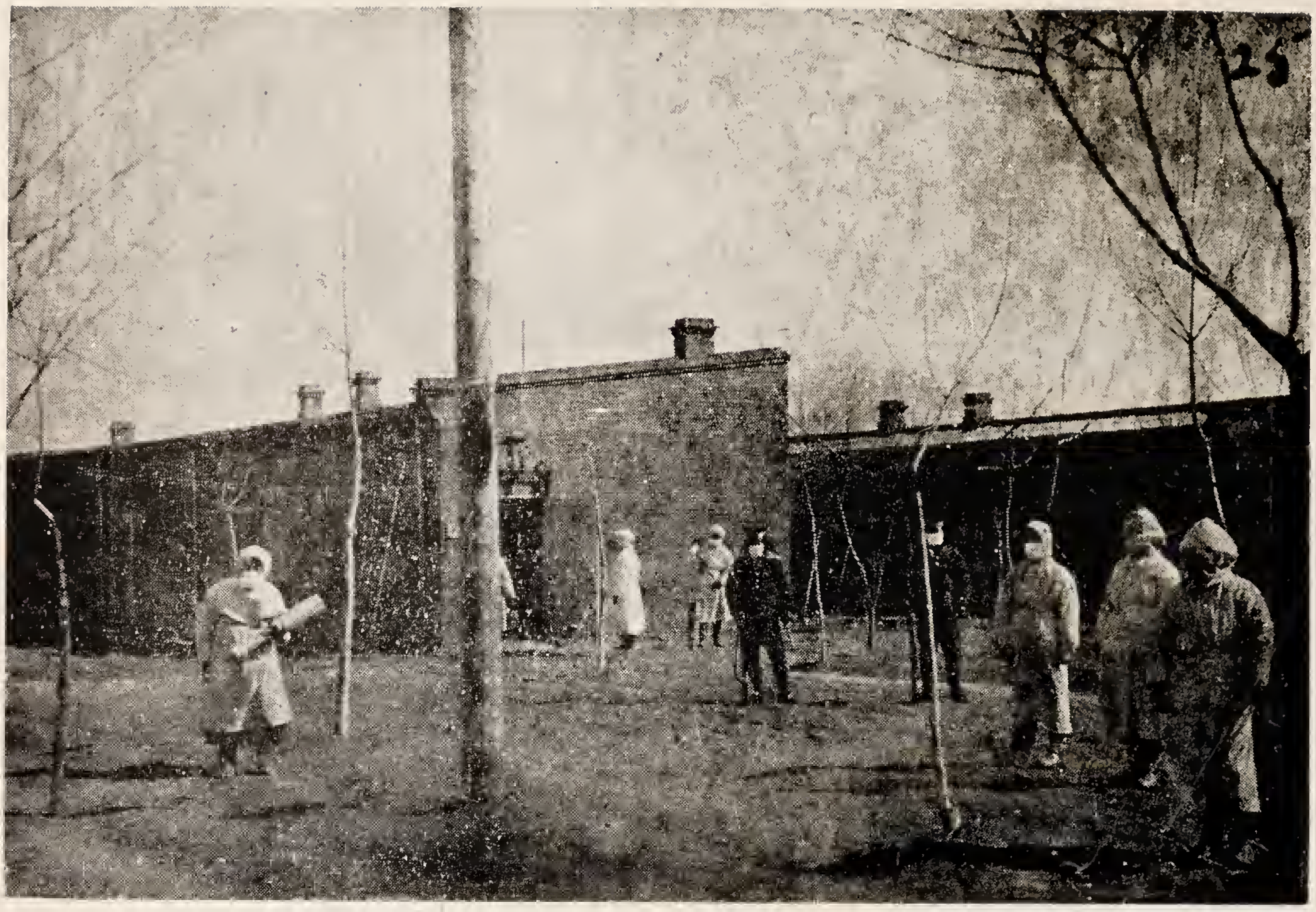
哈爾濱醫院

表示遠望東院（養疫病室）全部及西院一部圖



Harbin Hospital Main Laboratory, completed 1920.

哈爾濱醫院之細菌檢驗室



Plague wards with attendants, March 1921.

哈爾濱醫院患疫者之養病室與夫役圖

HARBIN HOSPITAL

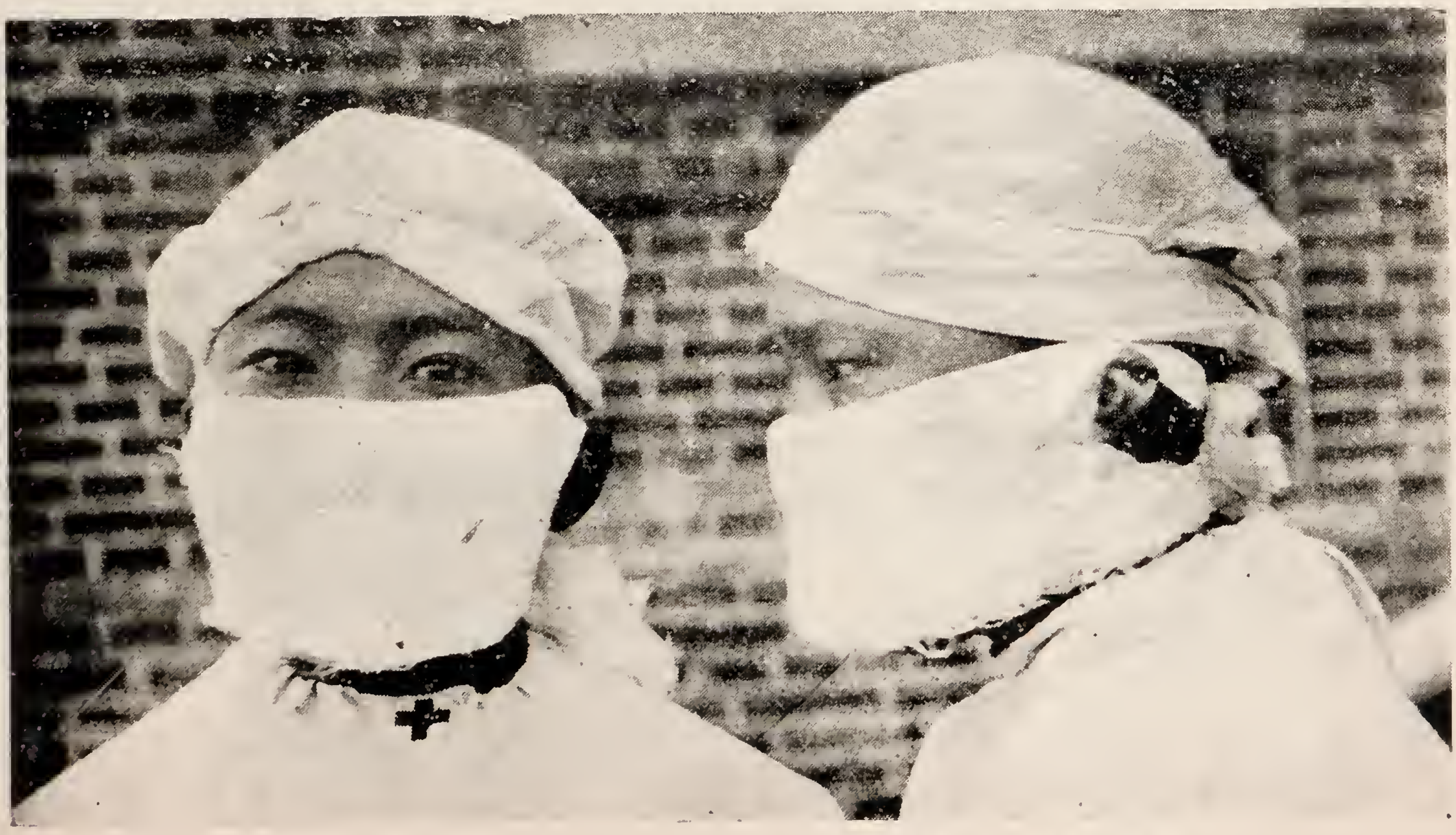
West (administrative) compound containing also general hospital.

哈爾濱醫院

表示靠西辦事大院與總醫院圖

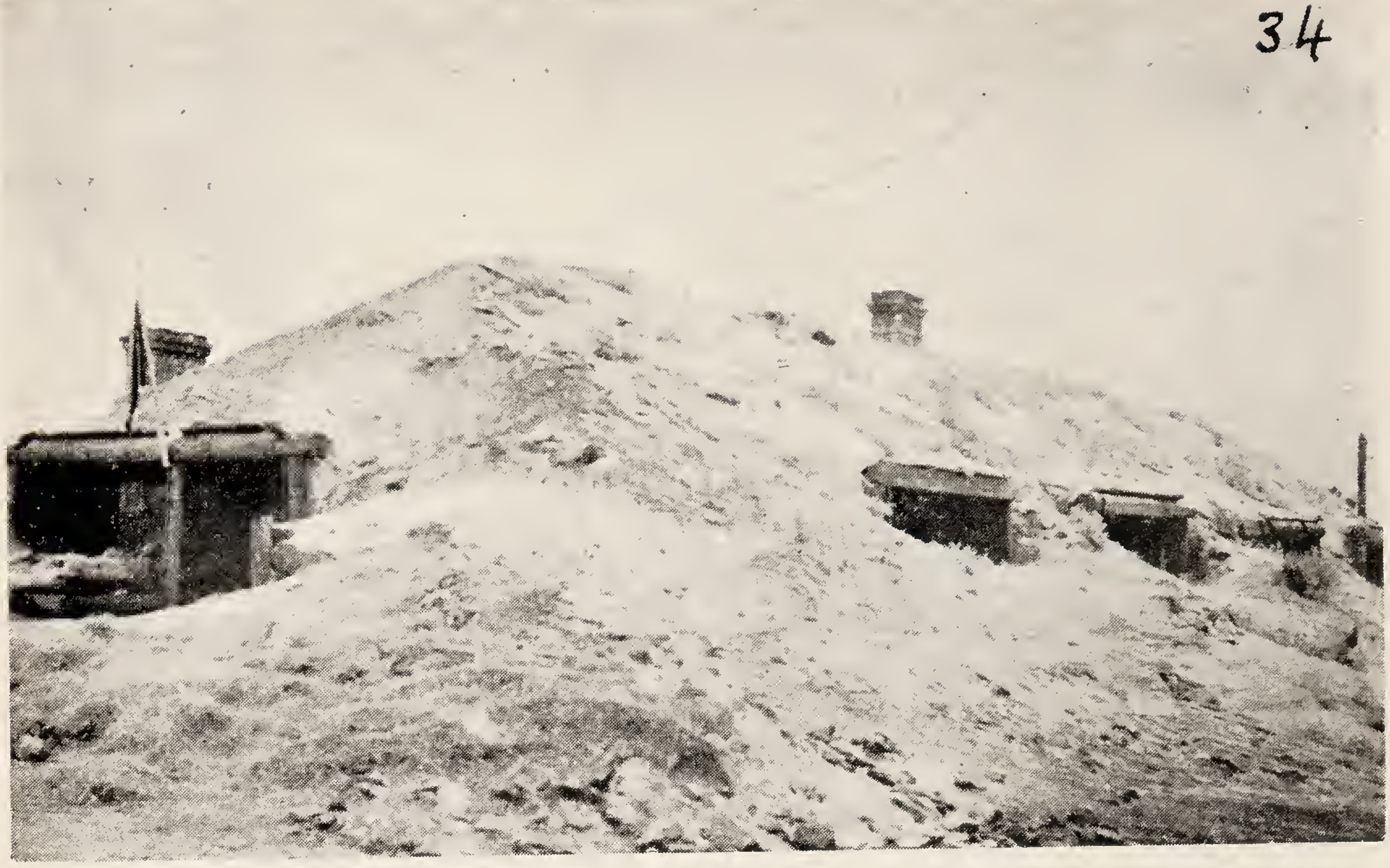
Harbin Anti-Plague Staff 1921. 哈爾濱防疫人員圖

Admitting Plague patients, Harbin, March 1921. 收留染疫患者圖



How anti-plague masks are worn. 護口具戴法圖

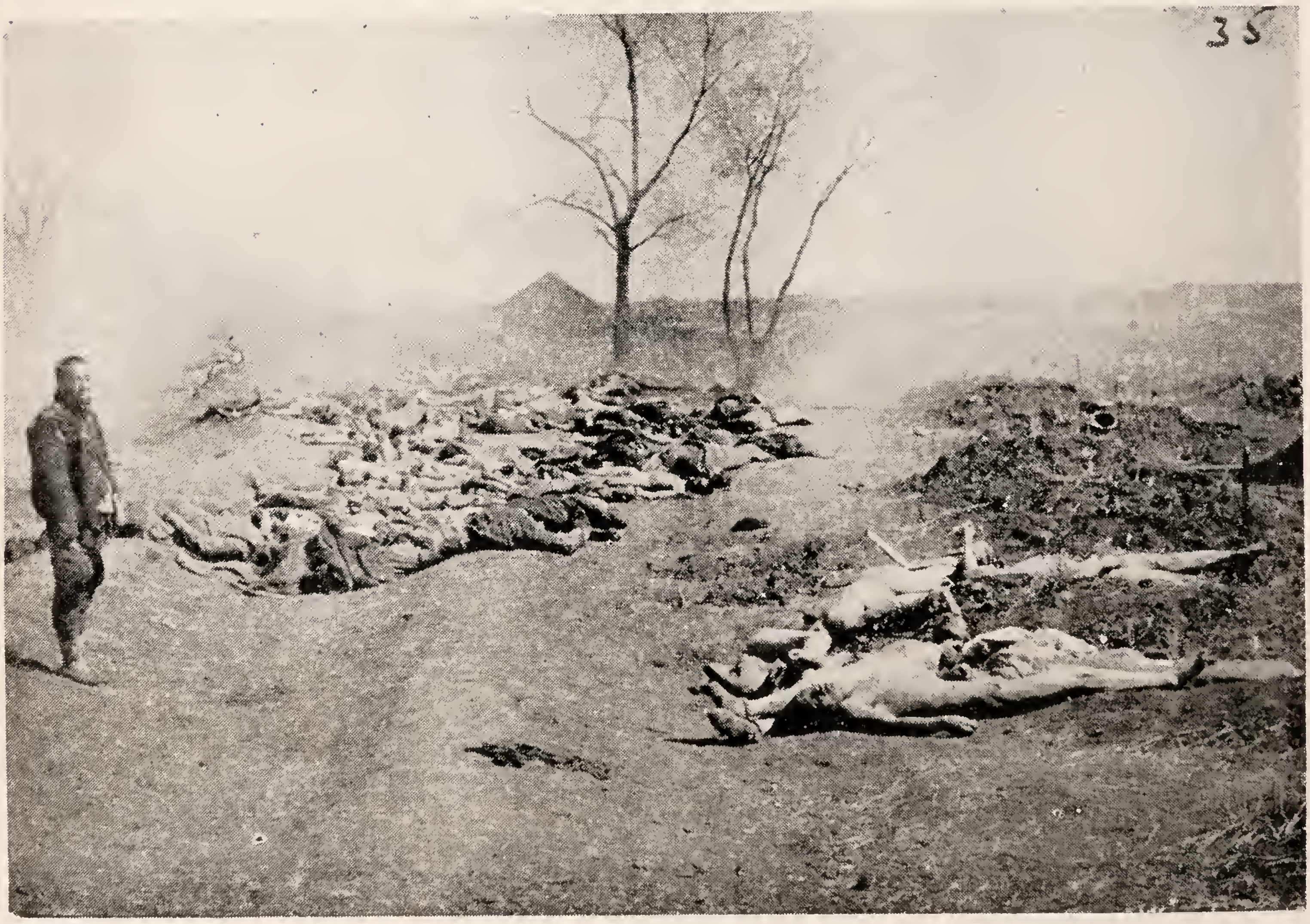
34



Semi-underground dwellings for miners at Dalainor, where 40-60 men often lived. Hot-beds for plague.

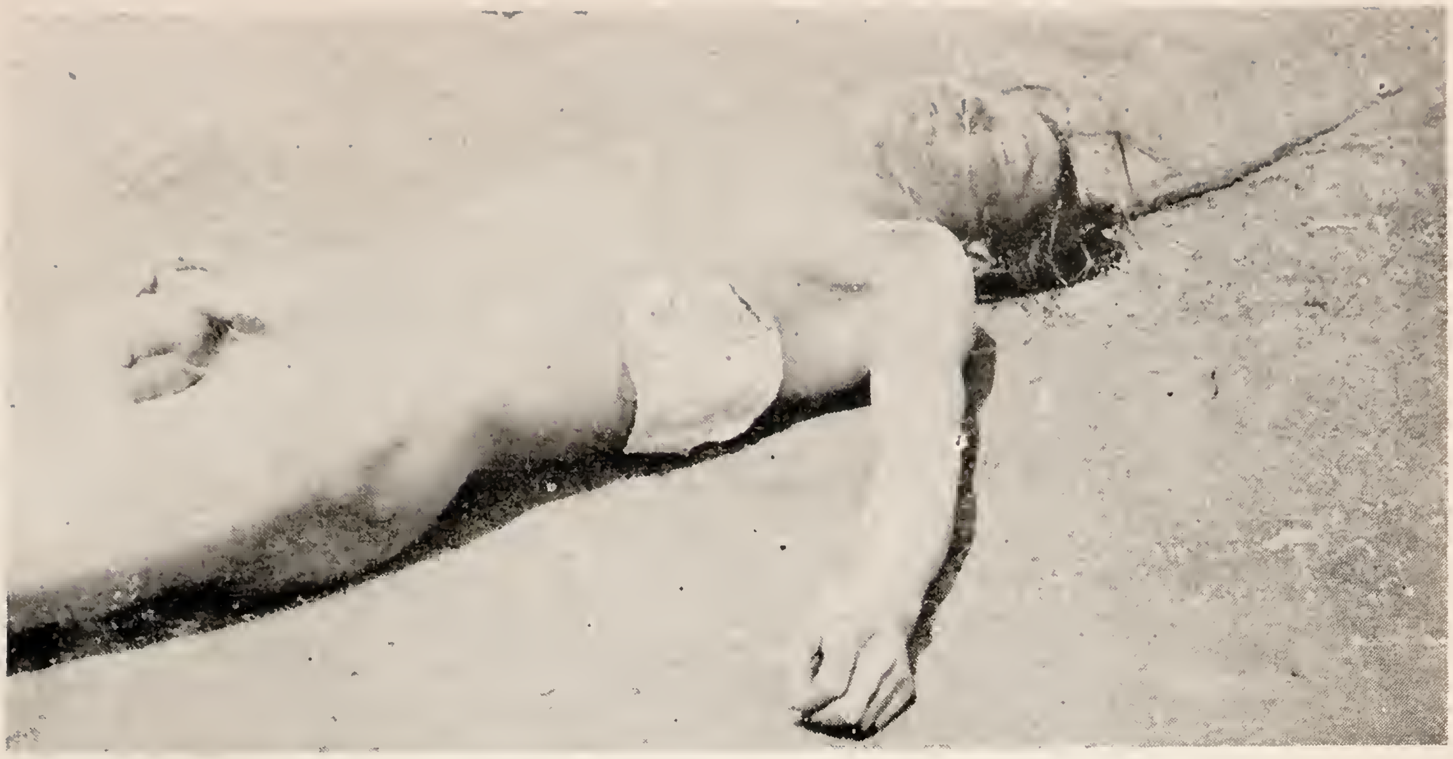
半居地穴圖　札拉諾爾鑛夫常以四十至六十人聚居一穴內

35

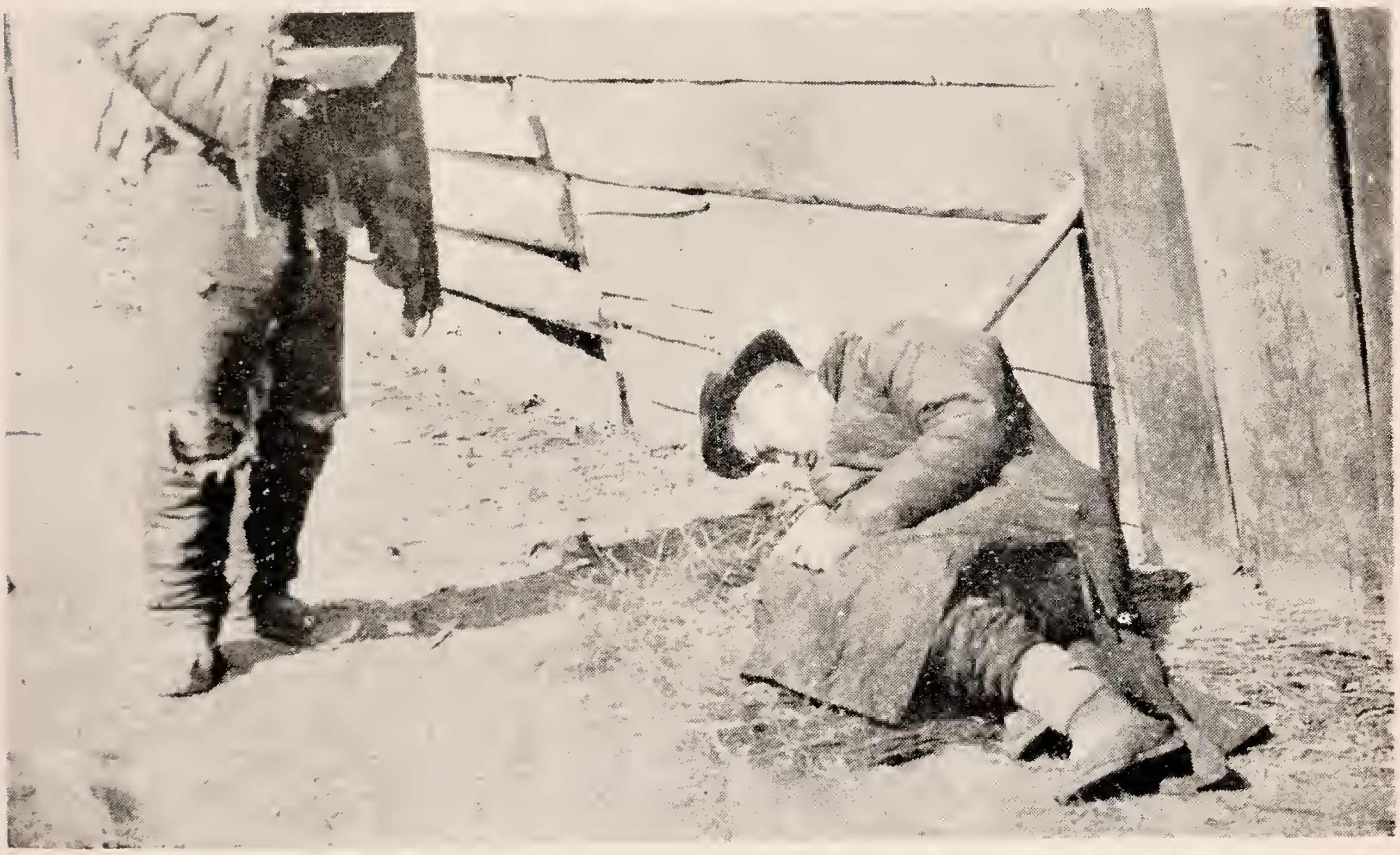


Public burial ground, Harbin. Corpses ready to be cremated.

公埋葬場圖　表示預備埋葬情狀



A dead plague patient showing plaster applied over spleen region by quack.
疫屍生前被庸醫在脾臟部帖粘膏藥之狀態



Plague patient (living) driven into the street. 患疫人棄在道旁之情狀

Remains of dead horse (middle) eaten by a dog. A plague corpse (right) was refused by same dog.
疫馬死後被狗食之而人屍則此狗不食之圖

OBSERVATIONS MADE DURING AND AFTER THE SECOND MANCHURIAN PLAGUE EPIDEMIC OF 1920-21.

(From the Plague Prevention Service Laboratory, Harbin, China).

CONTENTS.

I. Introduction

II. Experiments with plague sputum
- A. Exposure to direct sunlight and diffused daylight.
- B. Exposure to artificial cold surroundings.
- C. Exposure on wood and gauze.
- D. Experiments upon plague sputum and earth.
- E. Influence of disinfectants upon plague sputum.
  - 1. Action of liquid disinfectants.
  - 2. Action of slaked lime and milk of lime.
- F. Feeding experiments with plague sputum.
- G. Inoculation of Conjunctiva with plague sputum.

III. Experiments carried out in plague wards.
- A. Experiments upon coughing.
- B. Infectivity of rooms occupied by plague patients and their disinfection.
- C. Examination of clothing and money from plague patients and cadavers.
- D. Animal experiments with urine of plague cases.
- E. Observations upon contacts and plague carriers.
- F. Experiments with protective masks.

IV. Experiments with mixed infection—spore-bearing bacilli and B. pyocyaneus; vaccine and adrenalin.

V. Experiments upon non-susceptible animals.

VI. Summary of Conclusions.

I. Introduction.

The first Manchurian Epidemic of Pneumonic Plague came upon the world suddenly in the winter of 1910, raged for six months, and was suppressed in April, 1911. On this occasion nearly 60,000 persons died of the disease throughout Manchuria and North China. Apart from some new clinical observations made upon the infection, the urgent work of prevention monopolised the attention of our medical staff and left little or no time for experimental studies. Such specific experiments as were than made upon Pneumonic Plague were mostly carried out in Mukden about the time of the International Plague Conference (March-April 1911).

In 1912 the Manchurian Plague Prevention Service was established upon a permanent footing by the Chinese Government to cope with any epidemic that might again arise, and since then has successfully undertaken the task of epidemic prevention in these regions. Its officers also take part in the duties of public health administration and perform general clinical work in the many hospitals under its care.

Hence the second epidemic of 1920-21 found us ready to deal with the emergency, in which we received the co-operation of the official and merchant classes. In this outbreak, limited practically to North Manchuria and East Siberia, only 8,500 lives were lost among a population which had risen from 12 to 22 millions during the last ten years.

This state of affairs was particularly fortunate, because the time, formerly spent upon educational and propaganda purposes among the ignorant masses. was more fruitfully utilised in carrying out the clinical and scientific observations we had in mind for furthering our knowledge of this extremely fatal infection.

Nobody realises better than ourselves the incompleteness and inadequacy of our investigations, as these were rendered difficult by stress of circumstances, which frequently demanded their postponement in favour of more urgent duties connected with the combating of the epidemic. It is hoped, however, that our record may at least contribute to a narrowing-down of the various questions at issue. Should another occasion arise for further researches, we trust that our present observations may prove useful as preliminary data.

II. Experiments with Plague Sputum.

Experiments on a large scale have in the past been conducted by various observers upon the vitality of the plague bacillus and its resistance to various physical and chemical factors. All this work, however, was necessarily restricted to cultures of B.P. or to material from plague buboes: rarely were the experiments performed with sputum of pneumonic plague patients. In view of this scarcity of evidence we undertook some investigations upon plague sputum. These are now reported in the form of tables prefaced by introductory remarks.

A. Exposure of Plague Sputum to Direct Sunlight and to Diffused Daylight (Tables 1 and 2).

During the first Manchurian outbreak Shibayama[1] found plague sputum smeared upon glass to be sterile after 2-5 hours' exposure to direct sunlight, "the time varying according to the thickness of the layer of the sputum." When exposed to diffused light no growth was obtained after 18 to 21 hours, including 12 hours during the night. Toyoda and Yasuda[2] found sputum smeared on cover glasses to become sterile after exposure to direct sunlight for 1 hour or to diffused daylight for 6 hurs.

In our experiments we allowed plague patients to expectorate into sterile Petri dishes and exposed the untouched sputum to direct sunlight for ½ to 10 hours in the open air. The results of this investigation are seen in Table 1. The temperature, which appeared to have a marked influence in previous experiments with plague cultures[3] [4] seemed as important in our tests. With a temperature above 12°C. it was found by us that after a period longer than two hours the cultures proved either negative or showed only a few plague colonies. There was little difference whether the Petri dishes were open or covered. In every case the condition of the sputum after exposure was noted. The fact that we obtained some growths in almost half of the cases where the sputum appeared quite dry is not remarkable when remembering the great influence of the temperature on all drying experiments with plague cultures or smears.

The number of our experiments is too small to permit definite conclusions, but it seems evident, that an exposure to direct sunlight for 9 hours even at a low temperature and in covered Petri dishes killed the plague bacilli, irrespective of whether the sputum looked dry, half dry or unchanged. It must be noted that to complete the full period of exposure the sputum had to be kept overnight an a cool place. This, however, seems unimportant as all our exposures from 6 to 8 hours were also left overnight, and yet positive results were often recorded.

To supplement the above experiments we kept some dishes with sputa on the windowsill of rooms where no direct sunlight could reach them. The Petri dishes were not entirely closed, two pieces of wire separating the lower from the upper dish. The room as a rule stood at an average temperature of 10°C.; in some instances an unheated room was used with a temperature differing but little from that of the outside cold air. Again positive cultures were recovered from quite dry sputa. As can be seen from Table 2 we had positive results in two instances after 48 hours, whereas a dry sputum exposed for 96 hours in an unheated room with an outside mean temperature of 3°C. proved negative for B. pestis.

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[1] Mukden Report p. 18 P. C.

[2] Zeitschr fuer Hyg. und Infektionskr. Vol. 73, 1912.

[3] Simpson: Treaties on Plague, 1905, p. 91.

[4] Rosenau: Bull, 4. Hyg. Lab. U. S. Marine Service, 1901.

N.B.—We regret being unable to furnish accurate reading of humidity on the days of our experiments.

B. EXPOSURE OF PLAGUE SPUTUM TO ARTIFICIAL COLD SURROUNDINGS (TABLE 3).

The Bacillus pestis show remarkable resistance to intense cold in vitro[5] and in dead bodies[6]. Plague sputum has been proved to passess similar resistant powers. Wu Lien Teh stated that exposure of sputum in agar tubes to intense cold in a shaded place for 3 days did not affect the vitality of the bacilli.

Strong also found that if plague sputum was exposed in open air for one week, freezing each night, the plague bacilli were still alive and virulent[7].

During the Harbin epidemic we collected the expectoration of several plague patients in sterile Petri dishes, enclosed them in tightly fitting tin boxes, and placed these in a biscuit tin in the icecellar for periods varying from 26 to 208 days. The temperature in the icehouse was not below the freezing point. During the warmer period the sputa were kept in a cold-storage room with a constant temperature of -3° to -4°C. As can be seen from the Table we obtained positive results after 99 days, whereas the last examination, after 208 days, showed the dry sputum negative for B.P.

C. EXPOSURE OF PLAGUE SPUTUM OF WOOD AND GAUZE (TABLE 4).

Besides laboratory tests which established the fact that plague bacilli could survive on wool, cotton and similar materials for periods up to 76 days[8] and positive findings on fabrics contaminated by plague rats, some experiments akin to ours have been performed with plague sputum. The German Plague Commission found that silk, linen, etc., impregnated with sputum from pneumonic plague patients and kept under ordinary conditions, were sterile after 8 days: Shibayama[9] found plague sputum to be sterile when smeared upon cloth and exposed to direct sunlight for 6 hours daily for 5 days, and when exposed to diffused light in the shade for 13 days. Toyoda and Yasuda (l. c.) after smearing sputum upon soya bean cake and hemp bags obtained the following results:—

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[5] Kasansky, Cent. fuer Bakter, 1899, vol. 25.

[6] Mukden Report, pp. 87, 444, 446.

[7] Mukden Report.

[8] cf. Forster, Loffler and Gladin, Cent. fuer Bakter, 1899, p. 722.

	Sunlight.	*Diffused light.*
Bean-cake	sterile after 6 hours.	sterile after 20 hrs
Hemp bag	,, ,, 14 ,,	Not ,, ,, 20 ,,

It is to be noted that in the experiments extending over 14 hours the sputum had to be kept for another 16 hours during the night; for the 20 hour test, an extra 34 hours was required.

Experiments treating plague sputum on inanimate objects were performed on a large by Russian observers. Zlatogoroff[10] reported positive results after drying on paper and exposure to light for 6 days. Askanoff[11] found sputum kept on cotton in tubes in diffused daylight at a temperature of 22-23° to be virulent after 1 month in one instance; sputum kept at room temperature on filter paper in test tubes on the window sill and exposed to sunlight daily for 3 hours for 20 days was found by him to be still virulent when incubated in bouillon for 10 days.

In our own experiments the patients expectorated on pieces of wood or gauze placed in sterile Petri dishes. These-usually covered with sterile gauze-were kept in the corner of a slightly-heated room. As is seen from Table 4 we again obtained positive results from a number of dried sputa. From the Petri dishes not covered by gauze we cultivated plague bacilli from the sputum on wood after 24 hours, but not after 30 or 48 hours. The specimens on gauze in one instance still gave positive results after 48 hours. Sputa exposed in gauze-covered Petri dishes for 72 hours showed positive results for wood and gauze; after 96 hours, negative.

D. EXPERIMENTS UPON PLAGUE SPUTUM AND EARTH (TABLE 5-7).

Many tests belonging to this category have been performed by former observers. Tidswell[12] found plague bacilli dying out when mixed with sterile dust after 3 weeks.

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[9] Mukden Report p. 48.

[10] Second Report on Bacteriology and Epidemiology, Moscow 1912.

[11] Chmara-Barshefski, Plague Epidemic in Far East, Harbin 1912.

[12] Simpson p. 93.

Yersin[13] detected in 1897 bacilli resembling the B. P. in the soil beneath an infected house at a depth of 4-5 em., but of lessened virulence. Although many experiments of a similar nature were carried out in India, in no instance were plague bacilli isolated by a trustworthy observer, and it is doubtful if Yersin's bacillus was the real B.P. inasmuch as its cultural properties were not so well known.[14] Experiments with artificially infected sterile earth were performed by Gladin,[15] who found the bacillus surviving in moist sterile garden earth up to 3 months, and by Marsh [16]. The latter observer cultivated Plague bacilli from moist sterilised garden earth 13 days after contamination, and found them to survive in moist sterile cow-dung for many months. Rosenau (l c.) discovered the bacillus living for a long period if the sterile earth was moist, whereas drying and temperatures above 30° C. killed it in a short time. When the experiments were done with unsterilised earth the plague bacilli were found dead by most observers after 2 months. In a series of experiments performed by after a few days; only cladin (i. c.) was able to detect them Mackie and Winter in the Plague Research Laboratory, Bombay, with unsterilised cow-dung earth from the floor of an Indian house, B. P. were recovered from one of the samples 86 hours after the contamination, and one out of 4 animals injected with an emulsion of this earth. In the "Reports on Plague Investigations in India[17] experiments performed on 2 different kinds of floors, as encountered in India, were described. The first kind was made of cow-dung, the second with *chunam* consisting of a mixture of sand and lime. The conclusions reached were :—

(1) Floors of cow-dung grossly contaminated with bacillus pestis remain infective for 48 hours, the infectivity being tested by rubbing scrapings into susceptible animals.

(2) Floors of *chunam* grossly contaminated with B. pestis do not remain infective even for 24 hours, the infectivity being tested by rubbing into susceptible animals.

(3) Floors of cow-dung grossly contaminated with B. pestis remained infective for 12 hours but not for 24 hours to susceptible animals which were allowed to run about freely on them.

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[13] Annales l'Inst. Pasteur, Vol. XI, p. 81.

[14] Jl. of Hygiene Vol. 6, p. 509.

[15] Centralblatt fuer Bakter. Vol. 24, Part 1, p. 588.

[16] Indian Plague Commission 1901 Vol. 5, p. 101.

[17] Journal of Hygiene, Vol. 6 1906, p. 509.

(4) Floors of *chunam* grossly contaminated with B. pestis remained infective for 6 but not for 12 hours, the infectivity being tested by allowing susceptible animals to run about freely on them."

At the Mukden Conference 1911, no fresh data were brought forth on this point. It was mentioned by Strong that infection could not be disseminatetd by dry dust, and that the results of the experiments performed on floors in India could not be considered conclusive for Manchuria because the sputum would dry much slower than the moistened floors in India and so remain infectious for a longer period. Moreover, the possibility of its becoming frozen in Manchuria had to be taken into consideration[18]. According to Lancelin [19] *cultures magnifiques* of B. P. were obtained from the earth clinging to the shrouds of exhumed bodies during the first Manchurian outbreak.

In our experiments with plague sputum and earth three different methods were adopted: (1) sputum was *exposced* on fresh earth in the same manner as on wood and gauze, (2) sputum expectorated in sterile Petri dishes was *covered* with fresh or sterile earth, (3) sputum expectorated in such dishes was *mixed* with fresh or sterile earth. We started the experiments not so much with the object of determining how far plague sputum actually expectorated on the ground by patients would be a source of infection, but in order to learn how far the bacteria normally contained in the earth influenced the growth of the B. P.; the tests with sterilised earth acted as controls. In the first series (Table 5) the longest exposure after which B. P. could be recovered was 7 hours. In no instance of thoroughly dry sputum was any positive culture obtained. In our second series (Table 6) we obtained positive cultures after 12 hours' exposure, and in the third (Table 7) after 6 hours. In both latter instances fresh and sterilised earth furnished the same results. The experiments were purposely discontinued.

E. INFLUENCE OF VARIOUS DISINFECTANTS ON PLAGUE SPUTUM.

We are reporting under this heading only the experiments performed in the laboratory with different liquid disinfectants and with lime. The effects of gaseous disinfectants on plague sputum will be mentioned separately.

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[18] Mukden Report, p. 230.

[19] Arch. de Med. et Pharm. Nav. 1912 Vol. 98, No. 11, pp. 353-74

(1) ACTION OF LIQUID DISINFECTANTS UPON PLAGUE SPUTUM (TABLES 8 & 9).

Numerous experiments have been performed *in vitro* to determine the resistance of the B. P. against various disinfectants. Kitasato found the bacillus killed by a 2 hours' exposure to a solution of carbolic acid 1:200. Ogata attained the same result in 15 minutes but with a 1:20 solution, he could kill the bacilli almost instantly. A solution of corrosive sublimate 1:1000 was effective in 5 minutes. Klein [20] found a solution of pure phenol 1:80 sufficient to kill in 10 minutes, Izal 1:2000 in 10 minutes and 1:1600 in 5 minutes. Shibayama[21] reported success with sublimate 1:1000 after 1 minute; carbolic acid 1:100 after 10 minutes; lysol 1:100 after 10 minutes. Hankin [22] found permanganate of potash effective after 5 minutes even in a strength of 1:10,000. Simpson[23] stated that corrosive sublimate, though powerful in dilutions of 1:500 and 1.10,000 against the B. P. in the experiments, "is apt to lose its germicidal effect on discharges, sputum and the like by forming a coating of albuminate of mercury which protects the microorganism from being destroyed." For this reason he recommended, wherever possible, the addition of chloride of sodium and hydrochloric acid to the solution of perchloride of mercury so as to attain a strength of sublimate of 1:725 or 1:1500. As for permanganate of potash, which has the same disadvantages as sublimate when acting upon organic matter, he recommended a strength of 1 or 2% which was found to be sufficient for even an excess of organic matter [24]. At the Mukden Conference 1911, carbolic acid (with soap) or alkaline coal-tar products (cresols) were recommended for sputum disinfection; perchloride of mercury was condemned.

In Harbin 1921 we conducted several series of experiments with carbolic acid, perchloride of mercury, lysol, phenoid, potassium permanganate, peroxide of hydrogen, Izal, Lysoform, Antiformin and alcohol and employed the following technique:—

Small cotton swabs mounted on iron wires were placed in test tubes and sterilised by dry heat. 5 c.c. of fresh solutions of the antiseptic in different strengths were placed inside each tube. At the right moment the swab was dipped into the sputum contained in Petri dish, suspended in the antiseptic solution for the requisite number of minutes and then washed in the sterile normal saline solution to remove excess of antiseptic. After this, the swab was introduced into a fresh agar tube and a cultivation made. The same proceeding was repeated with the other solutions, care being taken to allow for as little discrepancy as possible in the quantity of sputum tested. The cultures were examined as a rule after 48 hours in the incubator kept at 30°C.

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[20] Bacter. and Path. of Oriental Plague 1906.

[21] Mukden Report, p. 47.

[22] Simpson p. 395.

[23] 1 c. p. 394.

[24] 1 c. p. 395.

As can be seen from Tables 8 and 9 the following concentrations of disinfectants were necessary to ensure the sterilisation of plague sputum :—

Carbolic acid 1 :10 to be employed for 5 minutes.
Perchloride of mercury 1 :500 to be employed for 20 minutes.
do 1 :1000 ,, ,, ,, ,, 30 ,,
Lysol .... 1 :50 ,, ,, ,, ,, 20 ,,
Concentrated alcohol ,, ,, ,, ,, 4 ,,

The following were *not reliable* even after 30 minutes :—

Phenoid	1 :50
Potassium permanganate	1 :500
Peroxide of hydrogen	1 :3 (30%)
Izal	1 :50
Lysoform	1 :50
Antiformin	1 :10
Alcohol	1 :2 (30%)

As compared with the results obtained *in vitro,* it can be seen that the popular method of sterilising plague sputum with the usually recommended liquid disinfectants is unsatisfactory. For this reason we have avoided them as much as possible in our disinfection work, relying principally upon methylated spirit for the disinfection of the hands, gloves, etc. We are still using it constantly in connection with our experimental work. Its inflammability should, however, be taken into consideration.

(2) ACTION OF SLAKED LIME AND MILK OF LIME UPON PLAGUE SPUTUM (TABLES 9 AND 10).

The use of lime in the form of slaked lime or milk of lime (usually in the strength 1 :100) was much recommended [25] in all cases where fumigation could not be applied for the disinfection of plague-contaminated objects. Jochmann [26] stated that milk of lime sterilised plague-contaminated faeces in 1-2 hours. At the Mukden Conference chloride of lime and slaked lime were mentioned among the useful disinfectants for plague sputum (p. 393).

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[25] Simpson, l. c. p. 393.

[26] Lehrbuch der Infektions-Krankh. 1914, p. 231.

We performed in 1921 a few experiments with lime powder and milk of lime (1:10) in the same manner as in the case of the liquid disinfectants and found them both reliable against plague sputum after 30 minutes; milk of lime even after 20 minutes (Table 9). When plague sputum was covered with lime, no positive growths could be obtained after 30 minutes, only doubtful ones after 15 minutes. Sputum expectorated on a layer of lime in a sterilised Petri dish gave a doubtful culture after 2 hours, a negative one after 4½ hours. It is perhaps well to remember that in the Indian experiments with grossly plague-contaminated floors referred to above there was a marked difference in favour of the chunam floors which consist partly of lime provided there were no pools of plague bacilli bouillon on them; otherwise the absorptive cow-dung floor was comparatively less infectious.

F. FEEDING EXPERIMENTS WITH PLAGUE SPUTUM (TABLE 11).

Feeding experiments with different plague-contaminated materials were carried out by different observers mostly upon rats with partly positive results, but as far as we are able to determine, plague sputum was employed for such tests only by Broquet[27] who fed 4 mice with food mixed with sputum from plague patients and had one positive result.

We fed 4 animals (2 guinea-pigs and 2 rabbits) with plague sputum mixed with their ordinary food. One guinea-pig and one rabbit died, but neither showed anatomical or bacteriological signs of plague.

G. INOCULATION OF CONJUNCTIVA WITH PLAGUE.

Human infection through the conjunctiva is extremely rare. A notorious case occurred in 1897 in the Parel Hospital (Bombay), where a nurse was believed to receive in the eye a particle of sputum coughed up by a pneumonic plague patient. She developed a bubo behind the ear and died. A similar case was reported in Hongkong. No new date in this connection were brought forth in the Mukden Conference. In the 1920-21 outbreak we did not observe any infection traceable to the conjunctiva.

Of two experiments upon susceptible animals, made by rubbing a swab dipped in fresh plague sputum upon one conjunctiva, we succeeded in producing positive results in a rabbit after 4 days. At P.M., an abscess in the subconjunctival region was noted, in which plague bacilli were discovered. Section of this tissue also showed some B.P. histologically.

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[27] Mukden Report, p. 229.

III. EXPERIMENTS CARRIED OUT IN PLAGUE WARDS.

A. EXPERIMENTS ON COUGHING.

Such experiments were performed during the first Manchurian outbreak by Toyoda and Yasuda [28] who found that plague bacilli were ejected by forcible coughing up to a distance of 3⅔ feet; and also by Strong and Teague [29] who obtained positive results up to a distance of about 2 meters (6 feet 7 inches) as judged by exposing a plate for 12 minutes.

We performed only a few experiments, in which the time of exposure was a short one (just as long as the patient was coughing naturally). The results can be seen in Table 12; we had one doubtful result at a distance of 5 feet, two doubtful at a distance of 3 feet, and a positive result at 2 feet. We discontinued the experiments because those of Strong and Teague's seemed to be indeed the last word on this subject.

B. INFECTIVITY OF ROOMS OCCUPIED BY PLAGUE PATIENTS & THEIR DISINFECTION (TABLES 13-15).

The question of the infectivity of rooms or houses where plague cases had been confined and of their disinfection has attracted much attention from both theoretical and practical standpoints. Much research in this respect (bacteriological and animal) has been carried out in India. All this work, however, has no direct bearing on the problem of pneumonic plague, because the main carriers of the infection in bubonic plague, namely, the rat and its fleas, are not present in pneumonic plague. This fact was emphasised at the Mukden Plague Conference 1911. [30] At this Conference the most divergent views were held by different observers in regard to the infectivity of houses and their disinfection. [31] The opponents of disinfection asserted that there was not much infectivity left after the patients had been removed from the rooms, so that disinfection seemed merely a waste of labour and materials. They cited instances where people staying in undisinfected houses had not contracted the disease, while others contracted the disease in spite of disinfection. The advocates of disinfection pointed out that in the latter case, perhaps infection had been contracted in some other way and cited cases where infection had taken place in undisinfected houses months after the first case. That danger lurked in "definite foci of infection from the sputum" (Strong) was suported by the investigations of Mischenski [32] who found "sputum retain its infection, even when half dried, for a month." Farrar's statement "that no definite evidence to the effect that houses or their contents remained infective had been put before the Conference" was contradicted by the Chairman, and the Conference eventually recommended disinfection of houses in the following manner: "Houses should be sealed up for a few hours immediately after removal of the patient or the corpse. Search should be made with a good light for visible contamination with blood, sputum, etc. Such contaminated matter must be forthwith disinfected or removed and burnt. The house must then be sprayed and swabbed with a disinfectant solution. Slaked lime may be spread evenly on a mud floor. When a house can be rendered air-tight, fumigation with formalin may be employed. The disinfection of furniture may be included in that of the house, or carried out by fumigation and exposure to sun. The spittoon must be thoroughly disinfected. The *k'ang*-mat and all rubbish should be burnt. House burning should not be carried out where it is found reasonably possible to disinfect.

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[28] Mukden Report, p. 49.

[29] Phil. Journal of Science Vol. VIII, Sec. B. No. 3 pp. 137.

[30] l. c. p 299.

[31] pp. 219, 298, 230.

1. INFECTIVITY.

Some tests were made in 1921 with agar plates in sick-rooms (Table 13) by exposing them for ½—1 hour at different heights away from the patients. The next series of experiments in this connection consisted in exposing guinea-pigs or rabbits kept inside tin buckets and placed upon the floor of rooms where plague patients were dying or had just died. This method was chosen to avoid any possible error arising from the animals becoming infected through another channel than the air. Previous records show that in the arrangement of the experiments (except one), the animals were kept close to the patient whereas our object was rather to ascertain the infectivity of the room *per se*. Toyoda and Yasuda [33] placed six guinea-pigs in a wire cage leaving it at different distances from a patient. None of the animals, which had been exposed for 12 hours, died. Shibayama [34] referred to 5 guinea-pigs which were kept for 24 hours near a patient coughing B.P. freely and exposed "in such a way as to receive materials coughed outright in their faces." All these animals remained free from plague. Strong and Teague[35] failed to infect guinea-pigs when exposed for 2 minutes at a distance of 5 cm. from dyspnoeic plague patients after having the abdomens of the animals shaved and extensively scarified. Raynaud[36] placed guinea-pigs in a plague-infected house but they remained healthy. Heiser[37] placed two guinea-pigs free from fleas and confined in a wire cage on the sleeping mat of a plague patient (bubonic). One of the animals, found free from fleas, died after four days of plague. After disinfection (spraying with kerosene and washing with a larvicide), new guinea-pigs were exposed in the room but they did not die of plague.

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[32] Zabolotny, p. 231.

[33] Mukden Report, p. 49.

[34] Trans. Second Biennial Congress Far East Assoc. Trop. Med. Hongkong, 1912 p 131.

The illness of Dr. Yuan on 17-20 February in our new Hospital block (steamheated and maintained at 17°C.) enabled us to make the first investigation regarding the infectivity of the sick room *per se* immediately after the death of the patient. For this purpose—12 guinea-pigs, two in each tin bucket, were placed on the wooden floor of the room, (12 by 10 feet with one large closed window) for periods ranging from ½ to 4 hours. Nothing was previously disturbed and the door was not opened except when the animals were removed at certain times. Four of the exposed guinea-pigs died. One of them exposed for 4 hours showed no plague infection, while the three others, exposed for ½, 1 and 4 hours respectively succumbed to septicaemic plague with congestion of lungs.

8 guinea-pigs in lots of two were exposed on 2nd. March to air of sickroom, ½ hour before, ½ hour after, 1 hour and 2 hours after death of patient. One animal died on 17th. March (i.e. 15 days after exposure) showing no bacilli in smears of organs though pure cultures from the blood were obtained.

4 guinea-pigs were allowed to stay in the plague room from 5-9 April where 6 patients had successively come in and died. One animal became sick, and on being killed showed lesions in the respiratory organs. No tonsillar or glandular infection was noticed. This experiment was performed on behalf of a Russian bacteriologist who at first believed the primary seat of infection to be situation in the tonsils .

Four other experiments were performed with 21 animals, but none succumbed to plague.

Similar experiments were also conducted at our request in March at Dalainor by Dr. Hsieh of our staff who exposed 10 young rabbits at heights varying from 1-8 feet to the air of a room (10 by 12) recently vacated by four dead. All animals survived.

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[35] 1 c. p. 154.

[36] Rev. d'Hyg. et de Police Sanitaire 1912 No. 8 p. 861-867.

[37] U. S Public Health Rep. 1913, Vol. 28 No. 10 p. 426-427.

Our series of experiments showed that out of 55 animals exposed for periods ranging from ½ to 96 hours, only 5 died of plague (2 after ½ hour's exposure, one after 1 hour's exposure, one after 4 hours' exposure and the fifth after 96 hours). 7 other animals exposed for 96 hours remained healthy, and showed no plague when killed. It might appear therefore that the sick room by itself even when the floor was covered by sputum was not particularly dangerous. As in Yuan's case conditions for infecting appeared more favorable in modern fitted buildings. We must, however, remember that these experiments were carried out mostly with guinea-pigs, animals which may not be so easily infected by inhalation "because they have a thick cluster of hair in their nostrils through which they breathe."[38]

2. DISINFECTION.

The last group of experiments under this heading consisted in exposing plague sputum in open Petri dishes, sometimes on the floor and sometimes on the windowsill in an unheated and almost empty room, and then disinfecting the room with formalin gas or sulphur fumes. The rooms used were well suited for disinfection, being part of our solidly built hospital buildings. Some previous experience may be quoted. Simpson [39]. stated that "formalin (gas) is destructive to the microbe in about 3 or 4 hours but has no penetrative powers and is accordingly insufficient." He regarded fumigation with sulphur as very uncertain and generally useless, and cited Hankin [40], who, in a disinfection experiment with sulphur after having sprayed the walls and the ceiling with water, found living plague bacilli though in diminished numbers.

In our 1921 Harbin experiments (Table 15) we found sulphur fumigation more satisfactory than formalin. In the former case bacteriological examination never once showed a positive result even after 12 hours exposure. It must be added that some suspicious findings were obtained after 12-24 hours' disinfection. The formalin disinfection showed positive growings after 24 hours in three instances. We regret that it was not possible to experiment with a Clayton apparatus, and that there was no time to carry out further tests in actual sick rooms with sputum on floors, beds and beddings, etc. It seems wise to make further experiments with the aid of animals at another opportunity, and to determine how soon an infected room loses its infectivity when left to natural influences after removal of the patient or corpse. We believe that such experiments will prove the effectiveness of nature in rendering an infected room innocuous apart from the directly contaminated objects. In that event, sanitary authorities will perhaps rely more upon nature's action than the vague and unsatisfactory methods of fumigation as at present practised. [41].

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[38] Shibayama, Experiments, etc., p. 131.

[39] p. 390.

[40] The Plague of India 1896. 1897.

C. EXAMINATION OF CLOTHING AND MONEY FROM PLAGUE PATIENTS & CADAVERS.

Instances of plague infection by infected clothing have been observed. Simpson [42]. cites a number of such instances. For this reason the possibility of infection through clothes was carefully considered at the Mukden Conference, 1911. Strong and Teague maintained that from a theoretical standpoint "the plague bacillus may be present (in articles of clothing) even though no particle of sputum may be visible upon them." Actual evidence was also brought forward of cases in which infection through such objects probably occurred[43]. The few bacteriological examinations recorded were negative[44], and other instances were mentioned where the clothes of plague patients were worn by healthy persons without producing infection in them. No instance of coins or banknotes causing infection was noted [45]. The attitude of the Conference upon this matter was therefore summed up as follows: [46] —

> "There has been no positive epidemiological evidence to show that infection has been spread by clothing, merchandise or other inanimate objects."

From observations made by us in the 1921 epidemic, both clinical and bacteriological, we cannot quite agree with the above statement. The clinical data will be supplied in another article. The bacteriological details are herewith submitted.

Pieces of cloth were cut from the coats on plague corpses and plated (Table 16). Although the examination of the plates proved very difficult because of many contaminating colonies, positive or suspicious results were obtained in not a few examinations. Owing to the scarcity of animals at the height of the epidemic, we were unable to confirm this evidence with animal tests. Towards the end of the outbreak some experiments were performed by inoculations with emulsions from plate cultures as well as by confining a series of rabbits and guinea-pigs in new coffins (partially closed) where some clothes freshly removed from plague corpses were placed. None of the animals thus exposed or inoculated died of plague (Tables 16 and 17). These negative findings might be due to decreased infectivity of the clothes on account of warmer weather and the prevalence of a pulmonary (not pneumonic) type of infection.

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[41] Practice of Medicine in the Tropics 1921, Vol. 1, p. 221.

[42] l. c. pp. 197-199.

[43] Mukden Report, p. 226.

[44] l. c. p. 228.

[45] l. c. p. 227.

[46] l. c. p. 389.

Paper money and silver coins from the dead also gave negative results in cultures and one animal experiment.

D. ANIMAL EXPERIMENTS WITH URINE OF PLAGUE CASES (TABLE 19).

Fujinami and we have successfully cultivated B.P. from the urine of pneumonic plague corposes. [47] The task of isolating B.P. from the urine voided by *living* patients was very arduous. In the "Report on Plague Invesigations in India" [48]. a survey of previous investigations on this subject showed positive findings of B.P. in such urine to be exceptional; also that in India detection of the bacillus in p.m. cases was often not possible. Kasai [49] reported one positive result in 6 clinical cases examined. In the Indian Report, experiments performed by injecting the urine of plague patients directly into animals showed positive results in nearly 30% in one series and 19.3% in another. Our 1921 Harbin records indicated one successful B.P. cultivation out of 30 specimens of plague urine examined. Of these, 23 were from living patients and 7 from corpses. The single positive finding was from a cadaver. Two guinea-pigs injected with urine (one from a living and one from a dead subject) gave negative results.

E. OBSERVATIONS UPON CONTACTS AND PLAGUE CARRIERS (TABLE 20).

During epidemics of bubonic plague single instances have been observed where patients with secondary pneumonic plague infection showed B.P. in their sputum for lengthy periods. One case was observed by the German Plague Commission, where the bacilli were present for 10 days and disappeared after 16 days. Gotschlich reported 3 instances [50]. where the sputum contained plague bacilli for 35, 41, and 76 days respectively. According to Mitchell,[51]. Rees "cited instances where the Bac. pestis in virulent form was present in the sputum of pure *bubonic* cases for as long as two months after recovery." Similar cases were observed by Cayley[52]. and others. Wilms found B. P. in the urine 4-6 weeks after the cessation of the febrile symptoms. In view of this evidence the Mukden Conference carefully considered the question of carriers and some bacteriological examinations were therefore undertaken. No positive result, however, was obtained, even in the remarkable case where a woman had doubtlessly infected several persons without contracting the disease herself[53].

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[47] Mukden Report p. 149 and our P.M. Findings in the present Report.

[48] Mukden Report. p. 177.

[49] Journal of Hygiene Vol. VIII, p. 221.

[50] Zeitsch. fuer hyg 1899, p. 402.

As can be seen from Table 20, we examined in 1921, 23 persons who had been living with plague patients, these contacts being examined soon after their admission into the isolation wagons. Among these 23 examinations, 20 proved negative for B. pestis; one case (No 215) could not be counted as a genuine carrier inasmuch as the patient soon after the examination was admitted into the hospital with plague pneumonia. The two remaining cases however had B.P. in their sputum (in one case also on the tonsils) without subsequently showing or developing any clinical signs of the disease. These two cases are so important that detailed descriptions may be given.

(a) Chang I, aet. 27, motorcar driver; was found with 18 other men in a crowded inn, where on the same day (Feb. 2) a man had died under circumstances suspicious of plague. When we went into the inn to examine the dead body, all the contacts appeared quite well except Chang, who complained of headache with a temperature slightly above 37°C. His pulse was not fast, and he gave one the impression of fright rather than any serious illness. His sputum was of an ordinary salivary character. Chang was sent with the other contacts to the isolation hospital, because spleen puncture of the corpse had proved positive. He had no more fever and felt perfectly well during his whole stay there. Smears of Chang's sputum taken on Feb. 2 showed no B.P. Agar cultures showed no characteristic naked-eye features, but B.P. like organisms were observed under the microscope. On Feb. 7 1/5 slant of the culture was injected into the peritoneal cavity of a guinea-pig. The animal died 18 hours after injection. Smears from the heart, peritoneum and spleen showed B.P. while cultivations from the first 2 organs gave pure colonies of the bacillus. On the Feb. 6 fresh agar cultures were made from the sputum and tonsils. All proved positive for B.P. and a guinea-pig injected on Feb., 13 with 1/5 slant of a sputum culture died after 24 hours showing B.P. in smears. Cultivations from heart, spleen and peritoneum were positive. Chang escaped from isolation on night of Feb. 7 and hence no further investigations were possible. This man was under close observation from Feb. 2 to 7, during which time he showed nothing abnormal. The specimens of sputum obtained on both occasions were by forcible coughing.

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[51] Journal of Hygiene, Vol. XX, No. 4, 1922.

[52] Indian Plague Commission, Chap. III, p. 92 of Report.

[53] Mukden Report, p. 226-228.

One of the 18 contacts, Wang, died unexpectedly on evening of Feb. 6, i.e. five days after his last contact with the sick man in the inn. As the incubation period of pulmonary plague is usually 3-5 days, it is quite possible that Wang might have been infected by the carrier Chang who harbored the bacilli for at least 6 days. The remaining 17 contacts continued healthy and were dismissed well.

Chang II, aet. 30, coolie, was one of 4 contacts examined on March 4 (No. 141), the other three giving negative results. His sputum was apparently normal and showed in smear preparations some B.P.—like organisms among cocci and other bacilli. Cultures looked suspicious. 1/5 slant was injected subcutaneously into a guinea-pig on March 6. The animal died after 18 hours. No plague bacilli could be detected in cover-glass preparations from heart, spleen and lungs, but the spleen culture showed one colony and that from the heart several colonies of B.P.—like bacilli. A guinea-pig injected intraperitoneally on March 8 with 1/5 slant of this heart culture died the next day (19 hours). P.M. showed B.P. in smears and cultures from spleen and peritoneum. Sputum and swabs from the tonsils of Chang were again obtained on March 9 and 13. All these tests however proved negative. The serum of the man did not agglutinate B.P. in a dilution 1:50 on March 18. The tonsils in both cases were examined clinically, but nothing abnormal could be seen.

Here is then proof positive of the existence of healthy carriers in pneumonic plague epidemics. Should further observations be possible, it will be necessary to ascertain by bacteriological tests of both sputum and tonsils if the percentage of "carriers" among contacts is really as large as our limited number of investigations appear.

Should such be the case, the "carrier" problem will have to be seriously borne in mind. Exposure of susceptible animals in the neighborhood of carriers, or better still of contacts in general, will then have to be undertaken.

F. EXPERIMENTS WITH PROTECTIVE MASKS (TABLE 21).

During the first part of the epidemic we performed some experiments with the simple cotton and gauze masks. These were of the pattern introduced by Wu Lien Teh and recommended by the Mukden Conference. When using them we always placed "cotton wool-plugs within the upper margin of the pad on either side of the nose to fill up the open angles"[54] Cultures were taken from the outer layer of gauze, outer and inner layers of cotton, of masks actually worn in the plague wards for various periods ranging from ½ to 4 hours. In only one instance, did we cultivate B.P. from the outer gauze of a mask—one worn continuously for three hours (Table 21). We had to discontinue these experiments, because after Dr. Yuan's death an additional precautionary measure was adopted in the form of a hood made of cloth with a oblong piece of silk (4 by 6 inches) sewn on in front to protect the respiratory entrance. The hood had two apertures for the eyes, and was tucked inside the overall at the neck of the wearer. One culture taken on March 3 from the outside of the rather moist silk-piece of a hood worn for one hour proved negative for B.P.

Marson[55] "holding gauze before the mouth of an infected patient and putting agar plates on the other side" obtained no growth of B.P. Barber and Teague,[56]. experimenting with B. prodigiosus by spraying, concluded that the Mukden cotton-and-gauze mask was inefficient because "it fails to conform to the configuration of the face and bacteria may pass directly through it." Dr. J.W.H. Chun of our laboratory sprayed emulsions of *B. acid lactic* upon masks mounted in metal frames and obtained similar results. When judging the protective value of the mask, stress should be laid upon the fact that in actual practice the mask is never put to such severe artificial tests as forcible spraying. Besides, in the plague wards one seldom stands within a shorter distance than three feet in the direct line of the patient's breath, and quiet breathing or an occasional cough is unlike the continuous spray used in the experiments.

IV. Experiments With Mixed Infection.

From past observations and actual experiments it has been established that the presence of other microorganisms is unfavourable both to the growth of B.P. *in vitro* (Yersin) and its virulence. Simonds[57] found that a plague culture accidentally contaminated by saprophytic organisms quickly lost its virulence. Such observations are quite familiar to laboratory workers. Daly [58] reported that in 1899 hundreds of plague corpses were stored in the mortuaries of Newchwang city and that "swarms of flies fed greedily on the juices exuding from these coffins. The caretakers lived in closed proximity, their dwelling rooms were full of flies and their food constantly fouled by them, yet not one of them contracted plague. Judging from this instance it would seem as if the putrefactive germs rapidly killed the pest bacilli." Simpson stated that the virulence of the B.P. was enhanced by the presence of streptococcus, while B. coli communis, B. subtilis, Staphylococcus and Micrococcus prodigiosus acted in a contrary sense. On the other hand, Bitter[59]. found the streptococcus inhibiting the growth of B.P. *in vitro.* Row introduced staphylococi into scarified areas round the buboes of plague patients and carried out experiments to study the reason of the favourable results obtained. In a paper read in 1905 before the Grant College Medical Society, Bombay, he stated that animals infected with plague could be saved by a subsequent injection (after 24-48 hours) with staphylococcus or with a mixture of staphylococcus and B.P. or by a pure culture of B.P. attenuated by symbiosis with staphylococcus. In a second paper read in 1906 before the Bombay Medical and Physical Society, he described the degenerative morphological changes in the B.P. in symbiosis with the staphylococcus and stated that "there is strong experimental proof that marked benefit ensues in guinea-pigs infected with virulent B.P. when they are treated 24 hours after infection by one or the other of the following methods :—(a) A cutaneoue scarification with live staphylococci in the vicinity of the pest infection. (b) A similar operation with a mixture of B.P. and excess of staphylococci grown in symbiosis." Row found "that the absence of the B.P. in the suppurating bubo is only apparent and not real, and the general failure to detect the B.P. in bubonic pus cultures is due to the fact that we get such an abundance of staphylococci in one or two days' agar growths that a slide smear shows no evidence of B.P. Nor is it possible to isolate the B.P. by infecting guinea-pigs by the cutaneous methods of infection described by Kolle, for, as will be pointed out later on, it seems to me that even were the plague bacilli present, they are in a state of attenuation-this being either per se or at all events when in association with staphylococci." He was however able to recover virulent B.P. by scraping the growth of staphylococci from the 7-10 day old cultures and incubating again for 24-48 hours. He thus obtained minute colonies on the surface of the agar and found in the smears staphylococci as well as degenerated plague bacilli, which when isolated in subcultures proved to be morphologically and experimentally true B.P. It should be emphasised that experiments with mixed infection should not rely wholly on agar but also bouillon cultures, as occasionally B.P. can only be recovered from the latter.

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[54] Mukden Report, p. 465.

[55] Mukden Report, p. 90.

[56] Phil. Jl. of Science, Vol. VII, No. 3, Sec. B. p. 255.

[57] Simpson, p. 90.

[58] Mukden Report, p. 309.

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[59] Rep. Egypt. Plague Com. Cairo 1897 cited in Hiss and Zinsser's Textbook of Bact. p. 31.

Mac Conkey [60] immunised guinea-pigs and rats by inoculation of cultures of *Pseudotub. rodent.* or filtrates of such for several months. Rowland [61] obtained the same results for guinea-pigs but not for rats. In 1921-22 we conducted three sets of experiments on mixed infection. While engaged upon the experiments dealing with the action of disinfectants upon plague sputum we noticed occasionally that on agar slants contaminated with sporebearing organisms no plague bacilli could be detected. We isolated therefore two such bacteria, one of which corresponded to *B. subtilis.* The other was found to be a strange bacillus. For information upon its charater we are indebted to Dr. Edgar Tsen of the Union Medical College, Peking. He reported that the bacillus in question did not belong to the usual class of non-pathogenic spore-bearing aerobic bacilli and thought it might be an undescribed species.

Its chief cultural and other characteristics are as follows :—

Motility—Non-motile.

Staining properties.—Gram positive.

Broth.—Growth is in form of a granular precipitate. Small amount of granular and stringy sediment but no surface growth.

Agar slant.—Abundant viscid growth, smooth and moist. Isolated colonies round, convex and opaque.

Agar stab.—Good spreading surface growth. Slight growth along upper part of stab ; no growth along lower part of stab.

Agar colonies.—Surface colonies round, yellowish, convex and viscid. Edges made of slightly curved parallel strands. Deep colonies small and irregular in shape.

Gelatin stab.—Growth along upper part of stab with funnel-shaped liquefaction.

Gelatin colonies.—Round colonies with fimbriate edges. Liquefaction sets in early.

Potato.—Abundant non-pigmented wax-like growth.

Loeffler serum.—Yellowish growth with slight liquefaction.

Litmus milk.—Gradual reduction of litmus. Peptonization sets in slowly.

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[60] Journal of Hygiene, Vol. VIII, No. 3, 1908, p. 335.

[61] Journal of Hygiene, 1912, p. 350-357.

Fermentation tubes.—Dextrose, mannite, maltose, lactose, and saccharose broths in fermentation tubes not fermented. (Incubation period 8 days).
Indol reaction.—Negative.

This bacillus will hereafter be labelled B. H.

While cultivating B. P. in combination with B. subtilis or B. H. on agar and bouillon, we obtained growths of both organisms, but apparently B. P. was somewhat retarded by the others. For this reason, we conducted the necessary animal experiments.

Series I.

Three guinea-pigs were injected intraperitoneally with mixtures of 1/5 slant of a virulent plague culture and 1/5 slant of the new B. H. The first animal succumbed quickly in 15 hours. At P.M. nothing unusual was found macroscopically. No bacteria could be detected in the films from heart, spleen or peritoneum. The heart culture remained sterile while cultures were used in this instance. Of the 2 other animals one had received 1/5 slant B. H. 2 days earlier. Both animals survived for an unusually long time (50 and 144 hours) Both showed at P. M. a circumscribed peritonitis near the diaphragm with a fibrino-purulent coating of the surrounding organs especially liver. Both B. P. and B. H. were recovered.

Series II.

2 guinea-pigs were injected with mixed cultures of B. P. and *B. subtilis* after having received previous injections of an emulsion of the latter culture alone. Again death occurred after a considerably longer interval (72 and 120 hours). The same localised reaction in peritoneum was noted in both animals, although the second one had been injected subcutaneously and not intraperitoneally. Both B. P. and B. subt. were found in cultures.—One rabbit was injected subcutaneously with 0,20 c. c. of a 9 day old mixed bouillon culture of B.P. and B. subt. (1922). The animal died after 96 hours surviving no longer than animals which had been infected with B.P. alone. Again an incipient circumscribed peritonitis was discovered although the animal had received subcutaneous injection. The heart culture proved sterile, while from the other organs both microorganisms grew.

Series III.

From a tarabagan contact (inhalation experiment) we obtained impure cultures of B.P. in symbiosis with other kinds, mostly *B. pyocyaneus* 13 rabbits were inoculated with these mixed cultures (Table 23) Two (R. 62 and R. 63) survived for a month and showed at P.M. afterwards, when used for other experiment, chronic changes traceable to the first infection. Two more (R. 44 and R. 60) showed no B.P. in cultures, only very doubtful ones in smears, so that they cannot be considered as having succumbed to a mixed infection. Four other rabbits died not long after the injection (24-120 hours) and showed at P.M. more or less marked signs of localised reaction. Their report is as follows:—(a) Rabbit 45 had a small subcutaneous abscess in the left inguinal region away from the site of the (subcutaneous) injection; pus from this showed some B.P. in both smears and cultures: no growth from heart or lungs. (b) Rabbit 47 showed besides a small subcutaneous abscess on the chest (in which B.P. and B. pyogy. were recovered) oedema of the subcutis of abdomen, hemorrhages in the fascia beneath, and a circumscribed peritonitis in region of ascending colon. Cultures taken from here showed both organisms. Doubtful growths of B.P. were obtained from heart and lung. No changes could be detected at site of subcutaneous injection. (c) Rabbit 49 showed abscess at the site of injection, the peritoneum being almost perforated with commencing peritonitis. Heart culture was sterile and a few B.P. were cultivated from the lungs. (d) Rabbit 48 showed oedema of the subcutis on right side of abdomen. The site of injection (subcutis of back) was not oedematous; only congested vessels were present traceable to the oedematous area.

NOTE.—The presence of abscesses in the neighbourhood of the peritoneal cavity, even in the four cases where the site of injection was in the dorsum, may be explained by the quiet somnolent and squatting attitude of the sick animals. which tended to produce abscesses by gravitation.

Five out of the 13 rabbits injected with these mixed cultures succumbed to the infection after a long period (9-29 days).

(i) Rabbit 46 was used 8 days after the mixed infection for another experiment as it was suffering from chronic skin disease, and had to be disposed of quickly. This animal died day after the second injection. A big abscess was found in the subcutis of abdomen apparently due to the earlier injection.
(ii) Rabbit 58 died 29 days after the mixed infection. Macroscopically, only congestion of the spleen could be noted. Smears from heart, spleen and lung showed few B.P. like bacilli. Heart culture remained sterile:

that of spleen showed one small colony and in subcultures only few P.B. like bacilli. It must however be stated that histological sections of spleen showed bipolar stained bacilli like B.P.

(iii) Rabbit 59, dying after 29 days, showed at P.M. an abscess in the pelvis most probably centered in the vagina. Smears from heart and spleen and cultures from spleen as well as sections from the embedded abscess showed B.P.

(iv) Rabbit 57 succumbed after 20 days, after $\frac{3}{4}$ loopful of a trachea subculture. P.M. showed considerable swelling of spleen studded with yellow nodules on surface and section; cultures were sterile while a few B.P. were recovered from heart culture.

(v) Rabbit 65 was injected with a mixture of B. pyocyaneus (3 parts), B.P. of lessened virulence (1 part). The animal died after 13 days, showing changes in spleen similar but much less marked than in Rabbit 57. Only a few B.P. were recovered from liver culture. Heart culture was sterile; spleen only showed non-plague organisms.

NOTE.—Some interesting points may be gathered from the above experiments:—

(a) long interval between infection and death in 5 of the 11 animals.

(b) chronic changes observed in the organs.

(c) scanty findings of B.P. (heart cultures were often sterile).

(d) this apparent attenuation in virulence may be due either to the influence of *B. pyocyaneus* or a lessened virulence of the B.P. recovered from the tarabagan (Table 12).

The two last experiments in this category seem to support the view of a lessened virulence of the B. P. (a) Rabbit 90, injected with 1 c.c. of trachea subculture mixed with 1 c.c. of a highly virulent B. P. culture, died after 3 days. P. M. showed haemorrhagic oedema of the subcutis of the chest similar to R. 48. Cultures from heart, spleen and liver showed few B. P. but plentiful *B. pyocyaneus*. A control animal injected with double the amount of same virulent B. P. culture (R. 92) died in after 4 days. (b) R. 100, injected with I c.c. of 24 hour culture of virulent B. P. mixed with pyocyaneus and incubated together, died in 27 hours. Cultures from heart remained sterile; those from the liver and spleen showed B. pyocyaneus (plenty) and B. P. (few). A control animal

(R. 101) injected with the same amount of plague alone, died in 4 days. A rabbit injected with B. pyocyaneus alone survived.

Conclusions.

From these experiments it will be seen that symbiosis of B. P. with B. pyocyaneus does not diminish the former's virulence. The alternative, namely a lessened virulence in the strain of the B. P. used, is therefore probable, and our earlier hope of effective immunisation with some such organism as B. H. or B. pyocyaneus, has not been realised. Nevertheless, in view of the evidence brought forward it seems to us that further research upon mixed infections should be prosecuted.

IV. Experiments with Pyocyaneus Vaccine (Table 25).

Preliminary tests *in vitro* upon the action of pyocyaneus vaccine on the growth of B.P. showed no retarding influence of this vaccine. Our experience with living pyocyaneus bacilli led us to perform some animal experiments with a mixture of B.P. cultures and pyocyaneus vaccine.

In the first of these experiments, the animal injected previously with B.P. and pyocyaneus vaccine and then on two successive days with pyocyaneus vaccine alone (R. 98) died 2 days later than control R. 97, which succumbed to an injection with plague alone after 3 days. As, however, this vaccine contained 0.50% of carbolic acid which could act upon the plague bacilli 15 minutes previously, this favourable result could not be considered as due to the influence of the vaccine itself. Two more animals treated with a combination of B.P. and pyocyaneus vaccine not preserved by carbolic acid died in 4 days. This result conformed with those generally obtained in the experiments performed at this time.

V. Experiments with Adrenalin.

Adrenalin has been tried in plague on a large scale [63] without favourable results. In 1922, our staff tested adrenalin in combination with plague vaccine and with antipest serum because of good results reported by Renaud [64] when treating serious cases of pneumonia with a combination of adrenalin and antipneumococcic serum. In the first experiment (Table 26) 3 animals were inoculated with plague. One served as control; the second was then reinjected on three consecutive days with plague vaccine; the third was treated in the same way as the second, except that 20 minutes before each vaccine injection adrenalin was given. All the animals died of plague, the control animal last. The animal treated with the vaccine-adrenalin combination was the first victim. No unusual findings were observed at P.M. .

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[63] Bull. et Mem. Soc. Med. des Hop. de Paris, June 23rd. 1921.

[64] Powell in the discussion of Row's paper 1906, 1 c.

One experiment was performed with B. P. mixed with *Bac. Acid lactici* (vide Table 24). We cultivated B. P. in milk and contaminated it 3 days afterwards with Bac. acid lactici and incubated. After 5 days 0·20 c. c. of this mixed culture were injected into R. 108, which died of plague in four days and showed both kinds of bacteria in films and cultures. The control animal R. 110. injected with B. P. cultivated in milk alone, died in 6 days.

R. 127 infected with plague and treated afterwards for 4 days with a combination of antipest serum and adrenalin died in 5 days of plague. This conformed with our results usually seen at that time. It may be necessary to make a series of intravenous injections of this combination (Renaud's treatment consisted of such) and to see if a quicker or better immunisation of healthy animals may not be obtained by this combined method.

V. EXPERIMENTS UPON NON-SUSCEPTIBLE ANIMALS. (TABLE 36).

Most investigators have not succeeded in infecting pigs and birds with plague. Both the German and Austrian Plague Commissions in India failed to produce plague in oxen, pigs and poultry. Negative were also the results of London, [65] who used various birds, and of Watkins-Pitchford, [66] who inoculated pigs and hens with virulent cultures and blood. Flu [67] found none of his chickens succumb to the infection; in one a local reaction (extended necrosis) with no B.P. was noticed. Bannerman and Kapadia [68] investigated pigs, fowls and ducks by feeding them with material from dead plague rats as well as by percutaneous and subcutaneous inoculation with the same material. None of the animals succumbed. Slight general and local reactions were observed in a pig infected percutaneously, while another pig showed a localised abscess. The German Plague Commission observed similar reactions in sheep, goats and cows, pus from sheep giving positive findings of B.P. Bannerman and Kapadia concluded that the positive results reported by Simpson [69] and Wilms [70] were due, not to a true infection of B.P., but possibly of a similar bacteria, which is only pathogenic to these animals.

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[65] Archiv. des Sc. Biolog., Inst. Imp. de Med. Exper. St. Petersbg, V6, p. 67.

[66] Hill, Rep. Plague Natal, 1902-3.

[67] Med. uit het Gen. Lab., Weltevreden, 3rd. Series A. 1919.

[68] Jl. Hygiene, Vol. 8. p. 209.

[69] Simpson. p. 106, etc.

[70] Wilms, Hygien. Rundschau 1897, p. 291, and Rep. to Sanit Bd. Hongkong 1903.

Our own 1921 experiments were performed upon 2 young pigs, 3 chickens and 3 ducks, which received subcutaneous injection. (Table 36). The pigs and chickens received big doses of B.P. cultivated two days before from human P.M. 22. As the animals remained absolutely well for two weeks, they were reinjected with fresh human plague blood from P.M. 27. The ducks were also inoculated with 1/3 slant of a 11 day culture from a human case (P.M. 33). There can be no doubt that our experiments fulfilled the requirements of Simpson, inasmuch as they were performed during the epidemic with material of high virulence. Yet none of the animals died of plague!

No general reactions were observed in any of our cases. Both pigs showed localised abscesses (size of a walnut) five days after the second attempt. Two examinations of the greenish pus obtained by puncture gave negative results for B.P., other organisms growing. It may be added that at the first puncture one pig struggled so fiercely that its peritoneal cavity was probably pierced through the abscess. No reaction occurred even after this accident. In one of the chickens, a small swelling was seen five days afterwards at the site of injection. Thickish blood was obtained by puncture, the smears showing no micro-organisms and the cultures only one minute colony (Pneumococcus).

One of the ducks died accidentally three months after the first experiment. The other birds survived for six months and were then killed by a weasel. The pigs were under observation for a year. The swellings in the pigs and chickens disappeared eventually.

VI. Summary of Conclusions.

1. We found that the B. pestis present in plague sputum, although more resistant than *in vitro,* was killed within 9 hours by direct sunlight at a winter temperature (-3 C). irrespective of other factors, e.g. temperature, humidity.

2 Mere drying of plague sputum is not a sufficient test of the killing of B. pestis under all circumstances. We have cultivated B. pestis from seemingly dry sputum in 40% cases after exposure in Petri dishes to sunlight, and in 60% cases when exposed upon wood or surgical gauze.

3. Disinfectants and antiseptics, even in strengths above those usually recommended, have not the generally expected results upon plague sputum. For instance, carbolic acid lotion, 1 : 10, requires 5 minutes to prevent growth of B. pestis in sputum. Concentrated alcohol (methylated

spirit) is the surest means of sterilising the hands and gloves in plague work.

4. Rooms where patients have died of pneumonic plague do not seem particularly dangerous. A modern-built, steam-heated room, with tightly fitting windows and protected from draughts, appear more dangerous, than old-fashioned native houses.

5. The disinfection of grossly contaminated articles, like floors, walls, etc., is necessary. The problem of fumigation of the air contents remains an open one.

6. The infectivity of clothing as a means of propagating pneumonic plague canot be neglected.

7. The existence of plague carriers has been proved in the 1921 epidemic.

8 The cotton-and-gauze mask, when properly applied, is the best means of personal protection against infection by inhalation. For those in constant and immediate contact with patients, we would advise the wearing of an additional hood with silk-piece sewn on in front, besides the use of goggles.

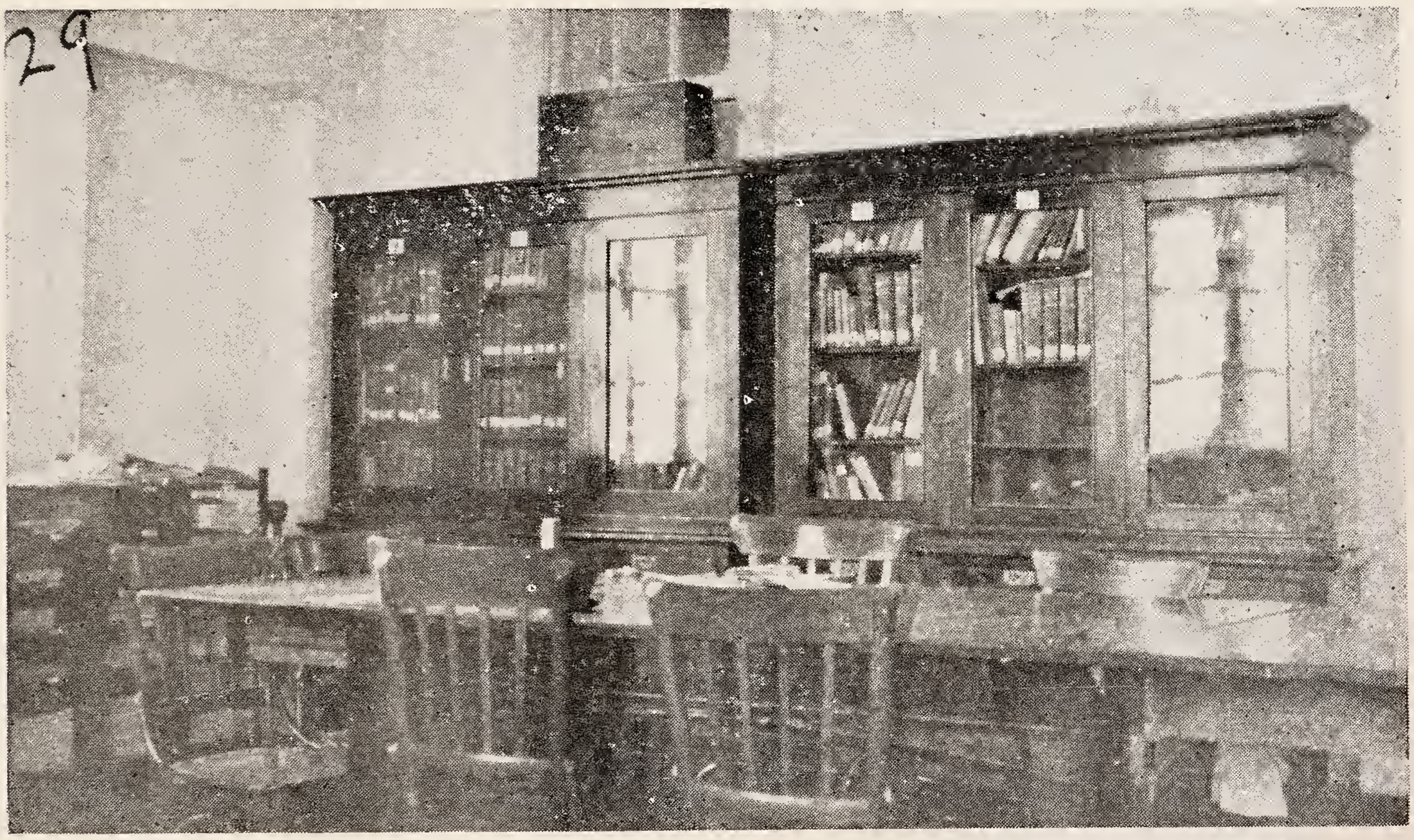
9 Pigs and birds were found to be non-susceptible to highly virulent fresh material.

Wu Lien Teh,
J. W. H. Chun,
R. Pollitzer.

28

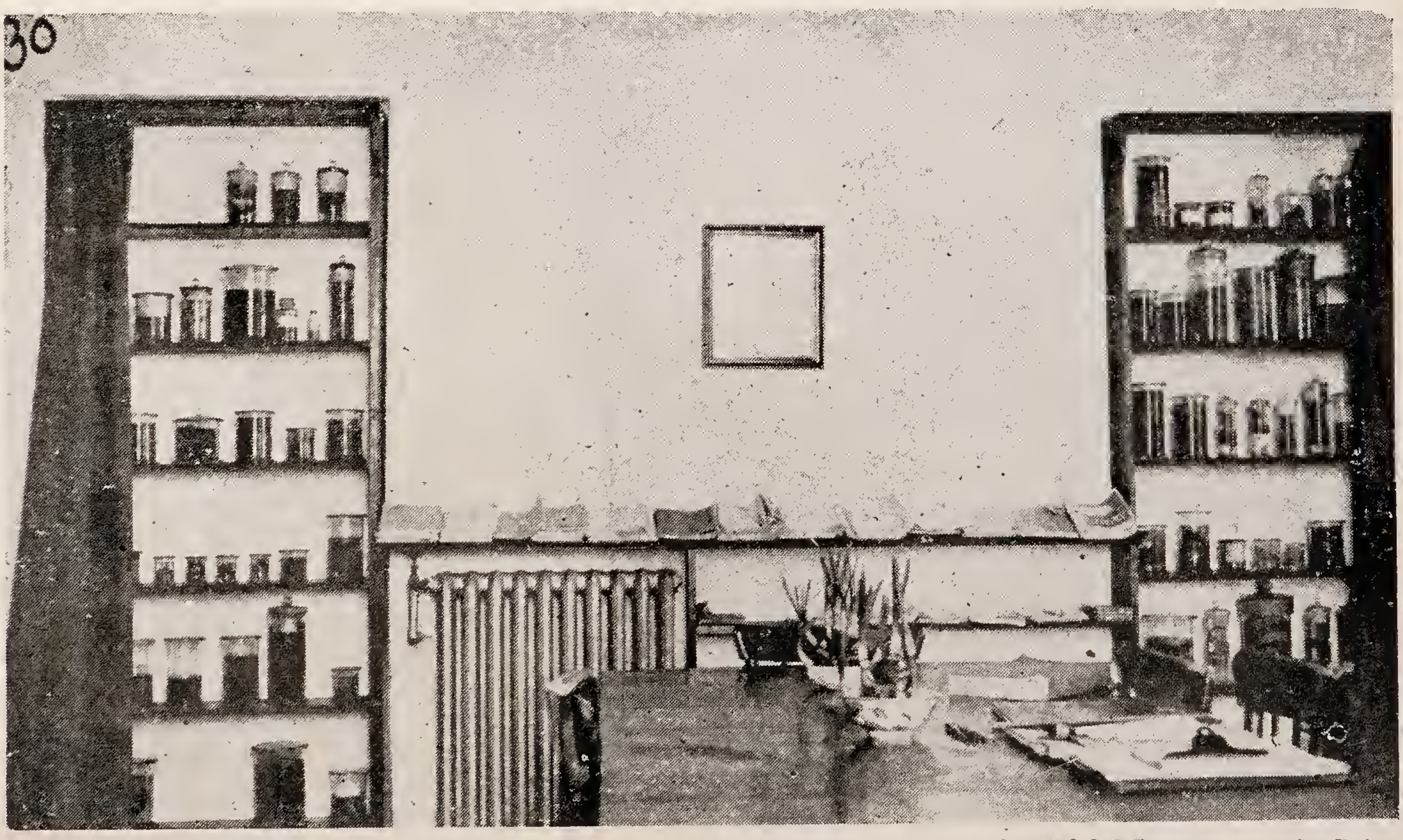
Harbin Laboratory (Interior) 哈爾濱細菌檢驗室內容圖

29



Library of Plague Prevention Service, Harbin. 哈爾濱醫院藏書樓圖

30



A corner of the Museum, showing pathological specimens. 哈爾濱博物室一部圖

THE ROLE OF THE TARABAGAN IN THE EPIDEMIOLOGY OF PLAGUE.

(From the Laboratory of the Manchurian Plague Prevention Service, Harbin, China.)

CONTENTS.

I. Natural Plague in Tarabagans.

II. Experiments Upon Tarabagans.
  A. Introduction.
  B. Inhalation experiments.
  C. Findings in inhaled animals.
  D. Findings in contacts.
  E. Experiments with faeces of tarabagans.
  F. Feeding experiments upon tarabagans.
  G. Conclusions from experiments upon tarabagans.

III. Addenda,
  A. Fleas and Ticks of tarabagans.
  B. Tonsillar infection in tarabagans.
  C. Chronic plague changes met with in our animals.

IV. Summary of Conclusions.

I. NATURAL PLAGUE IN TARABAGANS.

The question of the role which the tarabagan played in the origin and spread of the first Manchurian outbreak was widely discussed during and shortly after that epidemic. While much circumstantial evidence was brought forward and experiments were carried out to determine the susceptibility of the animal to infection with B. P. and thus to establish the importance of the tarabagan factor in an indirect way, definite evidence of animals sick with plague was rather scanty notwithstanding many endeavours made in this direction.

While the Chinese-Russian Expedition in the summer 1911 could not detect animals suffering from or succumbing to plague,[1] some suspicious sick marmots and corpses were detected by Russian investigators.[2] But in only one of these animals "complete evidence of plague was found" by Zabolotny.[3]

In the summer and autumn following the second Manchurian Plague Epidemic (1921), new findings were made by Russian physicians working in Transbaikalia near the Manchurian frontier. Medical Officer Kwan of our Service stationed at Manchouli was instructed to procure, if possible, material for bacteriological and histological confirmation in our own laboratory. He proceeded to Transbaikalia on the 21st. September 1921 and submitted a report of this journey, from which we quote the following data: At Soktu station a small laboratory was installed in a railway car and wagon, where the tarabagan question was investigated by Drs. Zokoff, Klotkoff and Shunoff and four students. Dr. Shunoff, seemingly an expert in laboratory work, had joined the laboratory only a few days ago from Chita.

Since the last summer daily expeditions on horseback had been made to find tarabagans suffering from plague. No plague was discovered among living tarabagans, but on the 16th. September a student, Pavloff, found the dead body of such an animal on the hills south of Soktu, which had largely been eaten by the eagles; on the following days he found two more of them. All those three tarabagans had inguinal buboes and appeared to have succumbed to plague as was proved at postmortem and by cultural tests. The macroscopic findings were:—enlargement and inflammation of the affected glands (no suppuration was detected), enlargement of the spleen, congestion (to a dark blue colour) of the lung without apparent pneumonia. Plague bacilli were found in all these organs and pure cultures of B.P. were obtained from the affected organs. On the 20th. September 2 guinea-pigs were injected intraperitoneally with pure cultures obtained from a bubo. The animal died after three days and showed B.P. in smears. Two other guinea-pigs injected the same day (20.9.21) were surviving up to the time of departure of our Medical Officer from Soktu.

Finally, the Russian doctors claimed to have found B.P. in one flea of a tarabagan and to have proved that it could carry infection to man. Thus the case of the Station-master of Dauria on the 1st. August was claimed to be due to this mode of infection and not to skinning or eating of tarabagans. Medical Officer Kwan had occasion to see this flea specimen under the microscope. He was given a cover-glass preparation of another flea to be examined at our Harbin Laboratory. Our Medical Officer suggested to the Russians to make animal experiments on this important question by exposing guinea-pigs to the bites of tarabagan fleas. Kwan sent to our Harbin Laboratory the following specimens :—

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[1] Wu Lien Teh, First Report of the North Manchurian Plague Prevention Service, Journal of Hygiene, Vol. XIII, No. 3, 1913, p. 239.

[2] Jasienski and Chmara-Borshevski, Plague Report of the Chinese Eastern Railway, Harbin 1912 and Wu Lien Teh, *l.c.* p. 253-254.

[3] Mukden Report p. 192.

Five stained cover-glass preparations
Two agar cultures from the tarabagans.
Pieces of spleen, lung and bubo of the tarabagans for histological examination.

The examination of these specimens in our Harbin Laboratory showed in two of the slides (from bubo of a tarabagan and spleen of a guineapig) bipolar stained bacilli similar to plague bacilli. Only few bacilli of the same appearance could be seen in a poorly stained smear from a culture of one of the tarabagan buboes. The slide marked "bubo of guinea-pig after inoculation" was not very well stained either, but it showed bacilli similar to the B. P. and others. No bacteria could be detected in the specimen of the tarabagan flea ; the specimen was incomplete and it was not possible to determine to which variety the flea belonged. Smears taken from both cultures showed B. P. in rather impure form. Experiments performed with these cultures (vide Table 27) gave in one case (Rabbit) negative results, while a guinea-pig succumbed 4 days after it had received a whole agar slant of the other culture. No pure cultures were obtained from this animal, and only doubtful results were seen in a rabbit which had been injected with its blood.

Histological examination of the specimens of organs sent showed only few plague bacilli. The piece marked bubo of tarabagan displayed small necrotic areas amidst the lymphoid tissue, while sections from the lungs were marked by signs of pneumonic infiltration.

Apart from the above-mentioned specimens sent by Dr. Kwan, it was not possible to obtain further confirmatory evidence regarding tarabagan plague from Transbaikalia.

There is no doubt, however, that at least one of the tarabagans found in the autumn of 1921 suffered from plague. Although this is the second occasion within the last ten years on which the existence of natural plague among tarabagans has been scientifically established, one should be chary about over-emphasising its *practical* importance in the origin and spread of human plague. In the case of the rat, it has repeatedly been observed that numerous cases of plague among them precede an epidemic among human beings, making a rat epizootic a vital factor in the etiology of human plague. In the case of the Siberian marmot no such chain has as yet been satisfactorily established. In spite of long and careful observations in the marmot regions during the past ten years, only isolated instances of tarabagan plague have been found. One is aware of the close relation of the domestic rat as compared with the wild tarabagan to man, so that an epizootic among *mus decumanus* is at once evident, whereas an epizootic among *arctomys bobac* in the Siberian wastes may well be over before a scientific expedition reaches the spot. To this circumstance is probably due the fact that the finding of plague-infected tarabagans in both instances was only made after human cases had been observed in the vicinity. Until the existence of plague among free-living tarabagans is scientifically established before a human outbreak or independently of it, the relation of tarabagan epizootic to human plague will have to remain an open question.[4] It is hoped that the second expedition which the Chinese Government is sending out in 1922 to the marmot regions may shed further light upon this interesting problem.

II. EXPERIMENTS UPON TARABAGANS.

A. Introduction.

Experimental infection of the tarabagan has been performed by previous observers by different methods. Thus, Strong and Teague[5] infected three tarabagans percutaneously and three by thrusting in a plague contaminated hypodermic needle. Five of these animals died of acute plague; the sixth, however, infected subcutaneously and killed a fortnight later, showed small necrotic areas in the subcutis near the site of inoculation and a similar area in the anterior portion of the abdominal muscles, swelling of the inguinal glands numerous yellowish nodules in the liver, a few in the spleen and one hyperaemic area in the right lung. Plague bacilli in small numbers could be demonstrated in abscesses and nodules. Two animals of their second series killed after approximately the same interval showed similar changes of a chronic nature. Strong and Teague pointed to the similarity of these changes with those found in chronic rat plague. The two authors performed also two inhalation experiments with tarabagans. One of the inhaled animals died after three days and showed a primary lymphatic infection and secondary septicaemia apparently due to accidental laceration of the mucous membrane of the mouth (the animal bit several times at the sharp metal nozzle of the spray) ; the second animal died of promary plague pneumonia. Dujardin-Beaumetz and Mosny[6]. inoculated three hibernating marmots with B. P. ; one of these died soon after, the two others survived for 61 and 115 days respectively, showing enormous numbers of B. P. in their organs. Zabolotny and Tschurilina[7]. reported similar results in tarabagans during the hibernating period. Their animals after inoculation with plague survived for 10-12 days, while the controls died after 3-4 days.

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[4] Occurrences of apparently *secondary* plague infection have been observed not only in domestic but also in free-living animals. Thus, Simpson (1. c. p. 129) cites instances of plague among monkeys and squirrels in India, and among different animals confined in the Zoological Gardens, Sydney. Berdnikow (Centralblatt fuer Bakter. Vol. 69, p. 258) considered this possibility for the plague-infected rodents of the Astrakhan Steppes but came finally to the conclusion that they suffered from primary plague.

[5] Mukden Report pp. 237 and 385 and Phil. Jl. of Science Vol. VII., Sec. B, No. 3, p. 224.

In order to obtain further proof of the role played by the tarabagan in plague, we decided to continue, and improve wherever possible, the experiments first started by us in Mukden 1917 upon the small marmot (*spermophilus citillus*) . For this purpose we utilised over fifty of the large variety (*arctomys bobac*) caught in the neighborhood of Manchouli and sent to our central Harbin Laboratory.

B. Inhalation Experiments.

In both summers of 1921 and 1922 inhalation experiments were performed, summer being chosen because of the greater facilities afforded in the open air. These experiments will be continued in the coming winter, when we expect the new better equipped animal laboratory to be completed. The results obtained up to date may be herewith recorded.

We used in the first series of experiments, 1921, cultures and subcultures from a purely pneumonic and a pulmonary human case, while in the second series cultures recovered from the tarabagans of the first series were used. In March 1922 a third series of inhalation experiments were started in which were employed cultures (a) from a tarabagan of Series I, dying after six months of chronic plague, (b) from a rabbit killed by culture (a), and (c) from the 1910 epidemic kept virulent by recent passage through animals. When comparing the results obtained with these different strains, it must be acknowledged that in 1921 the best results were obtained with the strain from the pulmonary case. There was no marked difference between the cultures and subcultures. In 1922 the strains from the tarabagan with chronic plague case gave very satisfactory results, while the two contacts kept with the animal infected with the 1910 strain survived up to July 1922 (4 months).

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[6] Compt. Rend. Acad. Sci. 1912, Vol. 155, No. 4, p. 329-332

[7] Berdnikow p. 257.

[8] American Journal of Infectious Diseases Vol. 20, No. 2.

As can be seen from Tables 28 and 31 nine animals were altogether infected by inhalation, six of which succumbed within 8 days, while 2 died spontaneously of plague after about three weeks. The ninth animal showed, when killed 17 days after the inhalation, positive findings. Of the 26 contacts nine died spontaneously. In the p.m. of four of these animals succumbing after intervals ranging from 20 days to 6 months, plague infection was clearly present. The five other animals died some months after their exposure as contacts, two apparently not of plague, while in the other three the results of the p.m. examination were more or less suspicious. Four more of the contacts were killed after a period from two to three weeks after exposure. In the postmortems similar suspicious findings were obtained. The rest of the contacts are still surviving up to the end of June 1921 and are apparently healthy with one exception—a small tarabagan, which seems thinner and more apathetic than the other animals.

SERIES 1921.

Tarabagans inhaled	6	Deaths	6
Contacts exposed	21	Positive plague deaths ...	2

N. B. None of the contacts died before 14th. day.

		Suspicious plague deaths.	7
Tarabagans inhaled	3	Deaths	3

SERIES 1922. (up to end June)

Contacts exposed	6	Positive plague deaths ...	2
		Suspicious plague deaths.	0

N. B. None of the contacts died before 19th. day.

The following inhalation technique was employed in 1921:—

The animal was firmly strapped upon the prepared stage with the nose held inside an iron muzzle. It was then covered with an oblong metal box without bottom and having a small circular aperture at the head and for the introduction of the nozzle of a spray. An emulsion of the culture to be employed was made with the aid of 10 c.c of saline solution and sprayed from a graduated cylinder fitted with a fine atomiser. All precautions were taken against a possible infection of the operators. The actual experiment was performed by doctors only, the assistants standing at some distance.

After inhalation the animals were kept in cages measuring two by two by two feet with iron bars on the top and covered with fine galvanised wire gauze. In two of the experiments the contacts were separated from the inhaled animals by a partition made of similar material, while in the three remaining experiments they were herded together. The results obtained with the animals placed separately differed in no marked degree from the second lot.

In the 1922 experiments, the same technique was employed except that we dispensed with the muzzle. In the former experiments it was found extremely difficult to fix the head of the animal firmly in the muzzle. Repeated attempts to do so resulted sometimes in slight bleeding from nose and mouth of the animals which we wished to avoid in the new experiments. The disadvantage of this new procedure, however, was that the nozzle of the spray could not be kept accurately directed against the respiratory entrance, so that in one instance the fur on the chest and abdomen was wetted with droplets from the emulsion. This point will be referred to again.

In future experiments we shall place the animals in an air-tight box with an iron lid, into which the indiarubber tubing of the spray will lead, thus obviating accidental lesions to any part of the respiratory entrances.

C. Findings in Inhaled Animals.

The details of the *p.m. findings in the inhaled animals* are set forth in Tables 29 and 32. All five inhaled animals of the 1921 category, which died spontaneously, showed in their respiratory tract more or less marked signs of primary plague infection similar to the changes in human pneumonic plague. T7, which was killed 17 days after inoculation, showed besides enlargement and congestion of two cervical glands, slight congestion of larynx and trachea and a semipurulent discharge in the bronchi, many abscesses of the size of half a lentil in the hyperaemic lungs. Few plague bacilli were seen in blood smears (taken from the heart and periphery) or in films from the congested lung tissue and a cervical gland, while in the smears from the contents of the bronchi, pus of the lung abscesses and the spleen no B. P. were detected. Cultures taken from one of the affected cervical glands and the bronchi were positive but impure. Only a few plague colonies were recovered from the lung. Hence this case forms in every respect a striking contrast to the others of this category, and inasmuch as the animal proved to be very strong and resistant when it was chloroformed there can be no doubt that we have to deal here with a subacute or even chronic form of pneumonic plague, comparable to the cases with chronic symptoms observed by Strong and Teague after subcutaneous infection.

Two of the inhaled animals of the 1922 series showed lung changes similar to, though in a lesser degree than, those encountered in the 1921 series. This seems remarkable as the animals did not die quickly but only 25 and 27 days respectively after inhalation. This phenomenon cannot be explained by a lessened virulence of the cultures employed, because one of them had recently been passed through rabbits, while the other culture proved to be of normal virulence when injected subcutaneously. In both instances, B. P. grew moderately in the cultures.

The p.m. findings in the third animal of this category (T107) which died 5 days after inhalation, seemed puzzling. The tongue was found congested, some of the cervical glands were swollen and hyperaemic. Haemorrhagic effusion was noted in the front cervical tissues and also in the upper larynx. The hemorrhagic patches present in the left lung appeared to be due not to an inflammatory process but to aspiration. There were ecchymoses on the epicardium. The spleen was big, but not soft; the liver showed fatty degeneration; the kidneys were congested. Ecchymoses were noted beneath the serosa of the stomach; its contents seemed normal and there were petechiae beneath the mucosa of the pylorus. The ileum was of blue-black colour; when opened it was found to be filled with reddish-black bloody masses; the mucosa showed a dark reddish brown colour, but no ulcerations or other pathological changes. Large intestine and contents appeared normal. Almost pure cultures of B. P. were obtained from the heart; spleen culture was contaminated. Liver culture positive but impure; from the ileum an almost pure culture was obtained, which in animal experiments exhibited unusual features but nevertheless proved to be B. P. We will deal with these experiments as well as with faeces cultures from T114 and T117 under a separate heading.

Summarising the findings of T107, it may be possible that the death of this animal was due to accidental causes. It was very strong, struggled fiercely when strapped upon the stage and when removed to its cage. Hence the hemorrhagic effusions in the musculature and upper larynx as well as the bloody contents of the ileum might be due to this struggle, but it is difficult to explain definitely the source of the blood in the ileum. If the cause of death be an accidental one, then we may trace the growths of B. P. to the inhalation five days previously with virulent bacilli. On the other hand, we may have to deal in this instance with a case of intestinal plague. It is therefore necessary to settle the matter by histological examination.

D. Findings in Contacts.

The p.m. results of *the contacts* in both 1921 and 1922 series are detailed in Tables 30 and 33.

The four contacts showing plain manifestations will be treated later. In the meantime, only the seven tarabagans with slight evidence of B. P. infection are dealt with here. These animals showed macroscopically either no changes which could be considered due to a plague infection (T11, T18, T115) or only slight changes connected with such an infection. Among these (T6 and T36) slight changes in cervical glands were noted; T36 showed also small yellow nodules in the normal-sized spleen. Another (T20) was emaciated, the thymus seemed bigger than normal, and spleen was acutely swollen. Finally T132, which was apparently killed by the other tarabagans, had a small grey spot on the epicardium which was surrounded by a hyperaemic zone and whose nature must be investigated histologically. The changes in the respiratory tract of T6, T18, and T36 might be considered as caused by chloroform narcosis by which these animals were killed.

In the three animals which died spontaneously months after exposure (T20, T115, T132), the cultures were sterile or negative for B. P., so that only in the smears, especially those taken from the spleen, a few bipolar stained bacilli resembling the B. P. could be detected.

One of the four killed animals (T11) showed in spleen cultures a few B. P. T6 had a few suspicious bacteria in the cultures from heart and spleen, more such in its trachea culture; T18 very few plague-like organisms in its heart culture and some rather doubtful bacteria from the trachea; T36 only very few plague-like bacilli in the culture from the trachea, while those from heart and spleen were sterile.

We do not lay undue stress upon these slight and not very definite findings. On the other hand, the results of these p.ms. should not be considered as negative, and every endeavour should be made to get more definite evidence upon this point. This question will be mentioned later on.

Two contacts of the 1922 experiments died spontaneously, one after 20 days, the second after 42 days. Both succumbed to plague infection, as proved not only by films and cultures but also by animal experiments (Table 33). Both animals showed small hyperaemic patches in the lungs and their spleen was bigger than normal. One animal had in addition some swollen and slightly congested cervical glands. It is noteworthy that contact T112 died one week *before* the inhaled T117, from which it was separated by a wire screen.

Two contacts of the 1921 experiments which died spontaneously displayed rather remarkable p.m. findings. In T12, dead 35 days after exposure, two swollen and congested cervical glands were noted, the tonsils were swollen and slightly congested, a small abscess was seen on the pharyngeal mucosa. Larynx and trachea were congested, the latter containing slightly pinkish froth. The lungs were so congested that they looked blue-black. The liver was congested; the spleen swollen and softer than normal-showed two small abscesses. Some hemorrhages were noted in the mesentery, Peyers' patches in the ileum seemed somewhat swollen. In smears from the bronchi B. P. were present mixed with other organisms. In the films from other organs a few B. P. were detected. Cultures from the heart remained sterile, those from the spleen showed few plague-like bacilli among other kinds (no pyocyaneus bacilli present). In cultures from the other organs B. P. were found mixed with others mostly B. pyocyaneus. The experiments performed with these cultures have already been reported (Table 23); they led to the conclusion that the virulence of the B. P. appeared somewhat lessened after passing through the tarabagans.

A particularly interesting case was that of T8 which died 6 months after exposure. At p.m. its thymus seemed slightly swollen. Haemorragic spots were noted in the left lung. The right lung was firmly adherent to the pericardium. The pericardial sac was markedly distended with much fibrinosanguineous exudate. The parietal layer of the pericardium was markedly thickened, while the visceral layer showed the appearance of the *cor villosum*. The spleen was acutely swollen and very soft. There was fatty degeneration of the liver. On the mesentery few haemorrhages seemed evident. Some bloody contents were noted in the stomach.

Culture of the spleen proved sterile; from the liver only few B.P. were recovered among other microorganisms. Cultures from the pericardium gave a pure growth of bipolar-stained Gram-negative bacilli, which through numerous experiments performed by both subcutaneous injection and inhalation (T114 and T117 with their contacts) proved to be virulent plague bacilli.

E. Experiments with Faeces of Tarabagan.

In the cultures from the faeces of T12, B.P. seemed to be present together with B. pyocyaneus, and in one of the two experiments performed with them (Table 23, R. 44 and

R. 49) both kinds of microorganisms were recovered from the cultures. From the bloody masses contained in the ileum of T107, bacilli similar to B.P. were also obtained in almost pure culture. Four experiments were done with this culture (Table 34). The first rabbit (R. 119) injected with 2 loopfuls of the culture and reinjected after 17 days with the same dose, died 24 hours after the second injection. At p.m. the lungs were found slightly hyperaemic. Some cloudy liquid was noted in the pericardium. There was a circumscribed fibrino-purulent peritonitis present near the diaphragm. The spleen was very big (see photo) and showed many solid yellow nodules (measuring up to the size of half a lentil) on its surface, where the nodules projected, as well as on section. The mesenteric glands were partly swollen. The significance of these findings will be mentioned later on. Suffice it to state here that smears from the spleen showed a few suspicious bacteria among other organisms, while cultures from the heart and liver proved sterile and those from the spleen gave a few colonies of suspicious bacilli. R. 122, which was injected with one loopful of this culture, died after 4 days, showing some subcutaneous abscesses in the thoracic region, an acutely swollen spleen and positive cultures of B.P. from heart, spleen and liver. In two other experiments with the ileum culture from T107 (R126 and R 130) death occurred after 5 days, and no evidence of infection with B.P. could be established R 135, however, died 6 days after having been injected with a subculture from the tarabagan culture, showing B.P. in spleen smears and heart cultures.

These positive results particularly attracted our attention, so we made in later p.ms. of tarabagans cultivations from stomach, ileum and sigmoid. Cultures which appeared positive or suspicious were tested by animal experiments. As can be seen from Table 34, we only obtained positive results with cultures from the intestinal tract of tarabagans showing plague findings in their other organs as well. Thus R 116, R 118 and R 120 died after inoculation with faeces cultures from tarabagans which had evident plague. R 125 died after having been injected with the stomach culture of such a tarabagan, and R 128 died after infection with a culture from the ileum. It should be expressly stated that in no case did macroscopical evidence reveal the tarabagans, from which these cultures were taken, as having suffered from an intestinal form of plague. These facts appear to coincide with the view of Zabolotny regarding the positive findings of B.P. in the intestine of plague patients. "That these observations did not, in his opinion, prove at all that there had been cases of primary intestinal plague. These experiment only showed that plague bacilli passed through the intestinal passages or came perhaps from hemorrhages of the mucous membrances of the bowels[9]".

The presence of B.P. in the intestines of these tarabagans cannot be explained by the supposition that the animals licked their furs which at times glistened with droplets of B.P. emulsion after the inhalation, because one contact separated by wire screen had also positive findings of B.P. in its intestines.

No positive results have so far been obtained in the experiments performed with intestinal cultures from two tarabagans with doubtful evidence of plague infection (T115 and T132) and from another with negative bacteriological findings (T133). This point will be discussed later on.

F. FEEDING EXPERIMENTS UPON TARABAGANS (TABLE 35).

It has been proved that certain species of rodents similar to the tarabagans can be successfully infected with plague-contaminated food. Thus Wu Lien Teh and Eberson had 4 positive results in an experiment conducted with 6 marmots of the species *Spermophilus citillus.*[10] Schurupoff[11] also stated that *Spermophilus guttatus* could be infected by contaminated food.

The question of the infection of the tarabagan (*Arctomys bobac*) *per se* was considered at the Mukden Conference, where Zabolotny suggested the possibility of its becoming infected by feeding on human plague corpses[12] According to the same observer human bones were found in holes of some tarabagans (p. 241). But as far as we are able to ascertain no definite evidence has been brought forward upon this point. Only one indirect feeding experiment has been carried out with tarabagans by Wu Lien Teh.,[13] who unsuccessfully fed a starving tarabagan with the corpse of another. To investigate the matter further we started a series of feeding experiments with tarabagans. So far we have not tried to change the regular vegetable diet of the animals except by adding large quantities (25 c.c. bouillon) of virulent plague cultures. Up to date the control rabbits have died after a short interval (5-8 days), showing only slight microscopic changes at p.m. though giving positive bacteriological findings of plague as verified by culture and experiment (Table 35). One tarabagan still survives (40 days after commencement) and is apparently quite well An attempt to recover B.P. from its faeces proved negative.

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[9] Mukden Report p 185.

[10] The Am. Jl. of Infectious Dis. Vol. 20 No. 2.

[11] Central. fuer Bakter. 1912, Vol. 65, Nos. 4-5, p. 243-256.

[12] l. c. p. 240.

[13] Journal of Hygiene Vol. XIII, No. 3, p. 256.

P.S.—This animal died on July 29, 1922, (2 months). P.M. showed enlarged and congested cerv. glands, marked congestion of resp. tract, meteorism of colon, haem. areas around lymp. glands in mesentery. Smears showed suspicious B.P. Cultures, esp. from intest tract, looked like B.P., but no definite results have so far been observed in animal exps.

The second tarabagan died after 19 days and showed at p.m., besides some swollen and hyperaemic cervical glands and pneumonic patches in the lungs, bloody mucus in the distended ileum where the mucosa was congested. No signs of ulceration were present. The rest of digestive tract showed no macroscopical changes. In smears from the spleen no definite plague bacilli were seen ; from the contents of the ileum plentiful B.P. were obtained. Cultures from heart, liver and spleen remained sterile ; from stomach and faeces only few B.P. could be recovered. From the ileum considerable growths (impure) of B.P. were obtained. Infection of the tarabagan by the alimentary canal thus seems possible, although the succumbing animal showed changes in the lungs as well as in the intestines, but the former appeared of secondary importance.

These experiments will be continued so as to comprise feeding with infected meat also—possibly from carcasses of plague stricken animals.

We have seen in exceptional instances the heads of corpses (T106, T132) bitten off and even partly eaten up by their bed fellows. By nature these animlas are vegetarian, and it is doubtful if such investigations may add much tc our knowledge of the eqidemiology of the disease.

In the same way that lung plague has been proved to occur in the tarabagan possessing all the features of human pneumonic plague, so the finding of intestinal plague among tarabagans may be said to pave the way for our belief in its existence also in man. There is substantial, but only clinical, evidence of the existence of an intestinal form of plague in man,[14], [15] but this has been much contraverted by such observers as Kitasato, Strong, Zabolotny, etc.[16] With such clear pathological evidence, which we have brought forth as a result of our Mukden and Harbin experiments upon marmots, it would be idle to deny even the possibility of a similar intestinal infection in man. Surely, its mere absence in 25 autopsies out of over 5,000 plague deaths in Mukden does not justify the attitude taken up by Strong in denying the existence of Intestinal Plague in man.

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[14] Simpson, pp. 291-292.

[15] Osler and McCrae, Practice of Medicine.

[16] Mukden Report pp. 185-186.

G. CONCLUSIONS FROM EXPERIMENTS UPON TARABAGANS.

Our experiments prove that, once started, plague among tarabagans may lead to two, possibly three degrees, of the disease. These are:—

(a) An acute form, with all the familiar features.
(b) A chronic localised form, showing quite unusual manifestions.
(c) Possibly a "carrier" form, marked by slight deviations from the normal found during and after life

Of the acute form, no more need be said as its nature and character are well known. In the chronic localised form, we have seen an animal (T8) survive for six months and then die spontaneously showing at death marked pericarditis. Another animal (T7) surviving for 17 days and then killed by chloroform, displayed several abscesses in both lungs and would certainly have lived longer if we had allowed it. These two animals obviously harbored virulent plague organisms and under favorable circumstances could have communicated the disease to man. Regarding the third category, plague-like bipolar-stained bacilli were found in small numbers in the blood and organs but we were not able to satisfy ourselves about the cultures or their infectivity. The fact remains, nevertheless, that this type of animal might serve, besides the chronically diseased tarabagans, as hosts for the plague bacillus. Moreover, it appears not impossible for this supposed carrier to "light up" under favorable conditions, such as happen in the case of colds, Pneumonia, etc., and become actively infective. The Indian Plague Commission [17] twice stated that the chronic (resolving) form of rat plague could not become acute, but other observers e.g. Swellengrebel and Otten [18] admitted this possibility for chronic animal plague. Clinical evidence tends to support the view of the existence of such a "carrier type." As late as September 1921, a localised outbreak of Bubonic plague causing four deaths occurred in Transbaikalia from the skinning and eating of some apparently healthy tarabagans by two Russians. Most Russian investigators believe in direct tarabagan infection as a cause of the almost yearly outbreak of plague among the people of these regions.

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[17] Journal of Hygiene, Vol. VII, p. 470 and Vol. X, p. 345.

[18] Archiv. f. Schiffs-und Tropenhyg., 1914, Vol. 18, No. 5, pp. 149-159.

We propose to perform in future direct injections with emulsions from the seemingly most affected organs of supposed carriers (spleen, cervical glands, thymus and sputum). Just as the gall-bladder seems to harbour the B. typhosus in carriers of that disease, so perhaps the organs mentioned above may have an affinity for the plague bacillus. Judging by our experiments upon the faeces in tarabagans, it appears that the intestinal tract does not possess such an affinity for the plague organism in 'carriers'.

IV. ADDENDA.

A. Fleas and Ticks of Tarabagans.

In a former Report we have described the flea infesting the tarabagan to be *Ceratophylus silantievi*, and the tick on the same animal to be a variety of *Rhipicephalus* (possibly *R. haemaphysaloides*). Our experimental work has hitherto been confined principally to the fields of inhalation and feeding, and hence the presence of these insects on their hosts has not apparently influenced our findings. At an early opportunity, we hope to study the role they play in conveying infection.

B. Tonsillar Infection in Tarabagans.

In every p.m. done upon the tarabagan we have carefully investigated the mouth and fauces, but, whether the cervical glands be affected or not, we have failed to locate any lesion in the tonsil or vicinity, which may suggest a possible entrance of the infection. This fact supports the view that infection through the tonsils in human plague is unusual, and lends additional weight to our postmortem findings. (See separate article).

C. Chronic Plague changes met with in our experiments.

It is difficult without histological examination to reach a definite conclusion regarding the changes occurring in animals which succumbed slowly to plague infection, whereby lesions of a chronic character developed. These results will be given in a future contribution.

The macroscopic changes due to chronic infection with B. P. are varied. We met quite insignificant changes as well as marked lesions. Among the latter, the findings in the spleen of some rabbits (R57, R65, R119) and tarabagans (T36) were noteworthy, as they seemed to correspond to the descriptions by Strong of chronic plague in the tarabagan.

It will also be interesting to see how far they resemble the lesions described as 'resolving' rat plague.[30] The changes observed in R59 might likewise be compared to the pelvic buboes in 'resolving' rat plague,[31] while R139 also showed nodules with necrotic centres in its omentum and mesentery.

IV. Summary of Conclusions.

1. The existence of sporadic cases of natural plague among tarabagans has again been established.
2. The tarabagan is easily susceptible to pneumonic plague produced by the inhalation of B. pestis in spray form, and may contract, besides the acute infection, a chronic type of the lung affection.
3. Our inhalation experiments have proved contacts to be liable to pulmonary plague infection in both acute and chronic forms. The existence of carriers among tarabagans seems also probable.
4. Tarabagans can be infected with plague by feeding upon artificially infected food, contracting an alimentary type of the disease. The B. pestis is easily cultivated from the intestinal tract of animals suffering from plague.
5. Our evidence shows that subacute or chronic plague may exist among tarabagans in Mongolia and Siberia, and thus form a connecting link in the epidemiology of plague in those regions.

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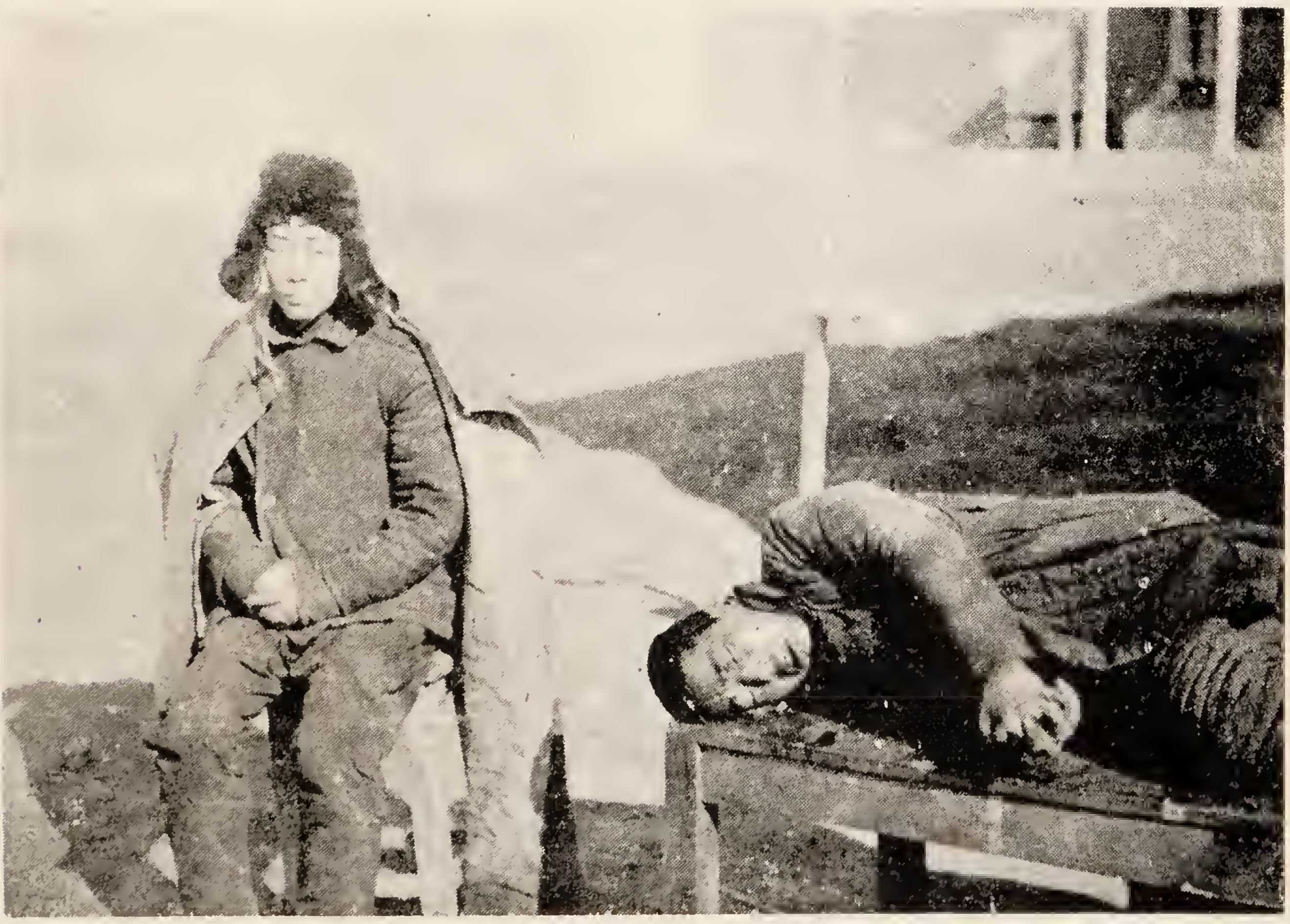
[29] Mukden Report, p. 439.

[30] Jl. of Hygiene, Vol. VI, p. 530: Vol. VII, pp. 359 and 457, Vol. X, p. 335. Plague Supplement 2, 1912, pp. 266, 287.

[31] Jl. of Hygiene, Vol. VII, pp. 463-464.

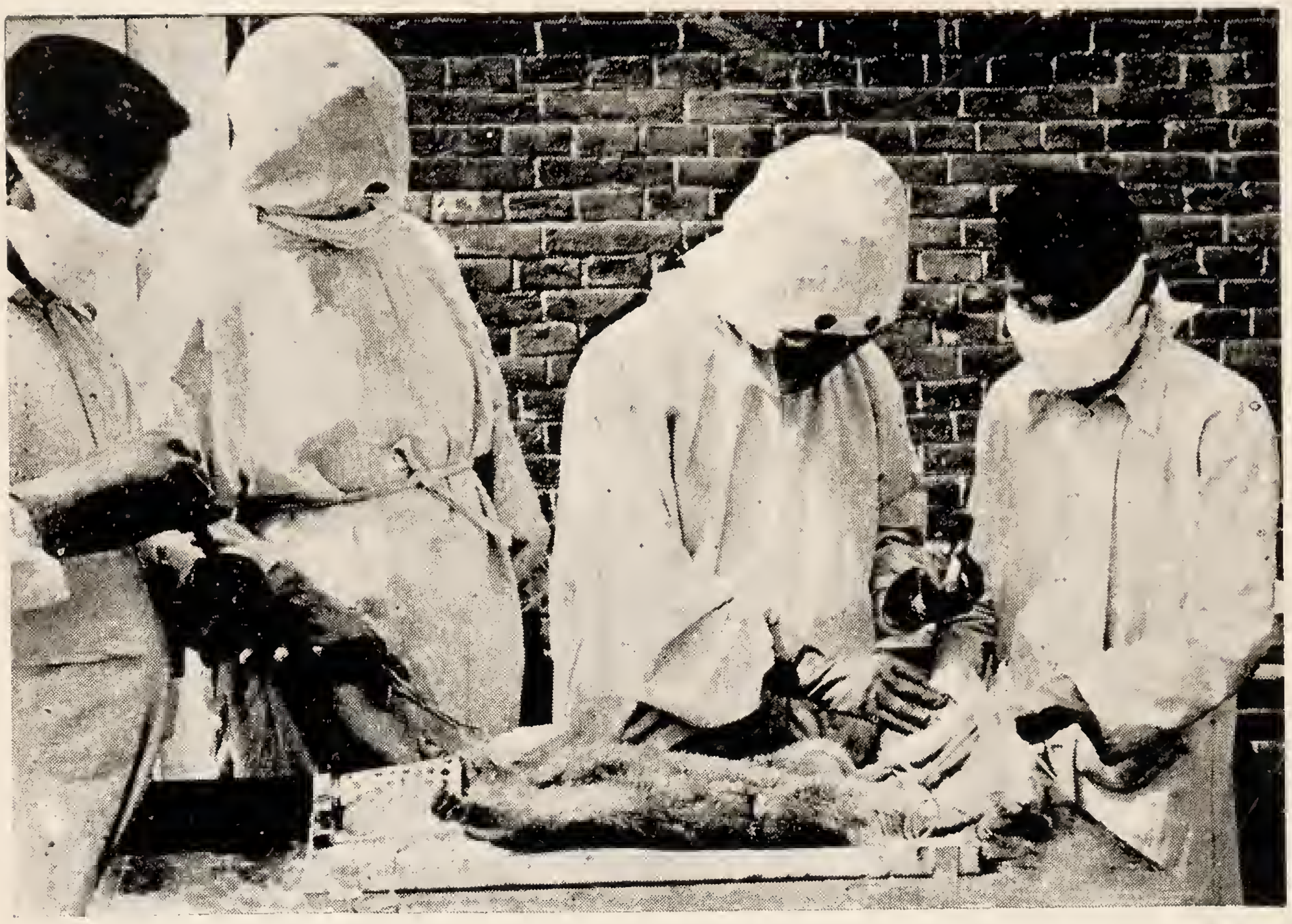
A group of Tarabagans or Mongolian marmots 〈*Arctomys bobac.* Schreb,〉 very fierce animals

示旱獺(蒙古山撥鼠)一群爲猛烈獸之一種



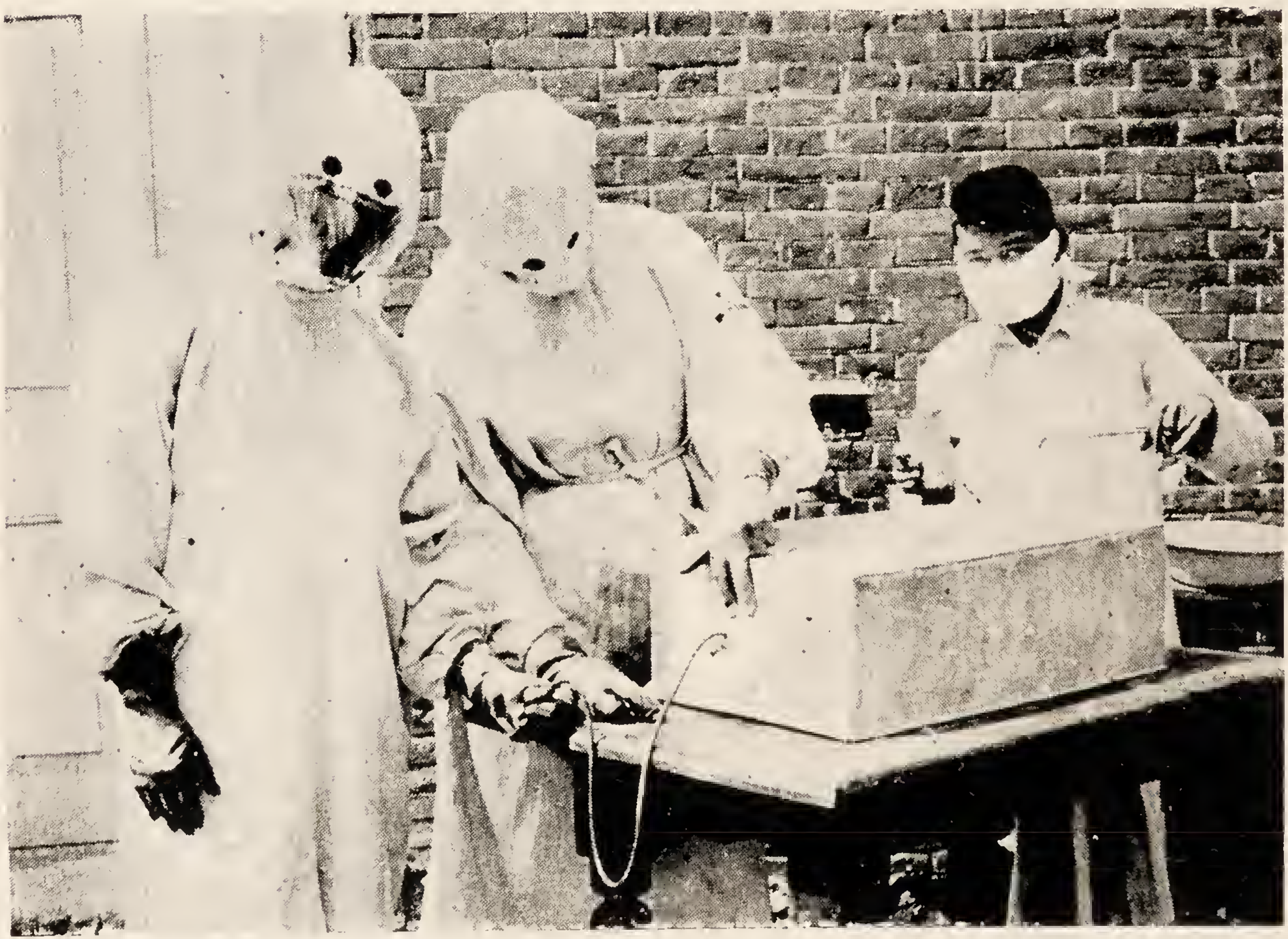
Two pneumonic plague patients, one in the early and one in the late stages of the disease. Note blood on bench.

示罹肺鼠疫患者一爲早期一爲極期



Plague inhalation experiments upon the tarabagan. First stage with animal strapped upon the table.

示行旱獺吸入試驗在第一期扣綁於術枱上



Ditto. Second stage with the animal covered and the nozzle of spray introduced into the chamber so formed.

仝上在第二期以噴霧器咀頭向箱內噴霧

TABLES 1-36 ILLUSTRATING THE TWO PREVIOUS ARTICLES.

TABLE 1. EXPOSURE OF PLAGUE SPUTUM TO DIRECT SUNLIGHT.

Hrs expd	Date	Time	Temp C.	Barom.	P. dish open	P. dish closed	Condit. sputum	Cult B.P.	Remks colonies
½	Mch. 1	11½-12	0	748.7	—	1	app. unch.	p	
½	,, 3	4 -4½	-3	747.0	—	1	,,	p	
½	,, 4	12 -12½	3	748.3	1	—	,,	p	
1	,, 3	11½-12½	-1	746.6	—	1	,,	p	
1	Ap. 3	12 -1	15	748.7	—	1	st. moist.	p	Few
1	Mch. 4	12 -1	3	748.3	1	—	app. unch.	p	
1	Ap. 3	12 -1	15	748.7	1	—	alm. dry	?	
2	Mch. 4	12 -2	3	748.3	—	1	app. unch.	p	
2	Ap. 3	12 -2	15	748.7	—	1	st. moist	?	
2	Mch. 4	12 -2	3	748.3	1	—	dry	n	
2	Ap. 3	12 -2	15	748.7	1	—	alm. dry	p	filmy gr.
3	Mch. 4	12 -3	3	748.3	—	1	app. unch.	p	
3	Ap. 3	12 -3	15	748.7	—	1	dry	?	contam
3	Mch. 4	12 -3	3	748.3	1	—	app. unch.	p	few
3	Ap. 3	12 -3	15	748.7	1	—	dry	n	
4	,, 3	12 -4	15	748.7	—	1	dry	?	
4	,, 17	12 -4	9	744.1	—	1	app. unch.	p	
4	,, 3	12 -4	15	748.7	1	—	dry	?	
4	,, 8	12 -4	8	746.5	1	—	dry	n	
4	,, 12	12 -4	19	738.5	1	—	dry	p ?	few
4	,, 15	12 -4	10	749.1	1	—	dry	p	
4	,, 17	12 -4	9	744.1	1	—	dry	p	few
5	,, 4	12 -5	3	747.0	—	1	app. unch.	p	
5	,, 17	12 -5	9	744.1	—	1	st. moist	p	
5	,, 8	12 -5	8	746.5	1	—	dry	n	
6	,, 8	x	3	746.6	—	1	dry	p	few
6	,, 10	x	9	745.2	—	1	app. unch.	n	
6	,, 15	x	5	748.5	—	1	st. moist	n	
6	,, 17	x	4	744.6	—	1	,,	p	
8	Mch. 9	x	10	754.0	—	1	app. unch.	p	
8	,, 9	x	10	754.0	1	—	dry	p	few
7	,, 12	x	13	739.2	—	1	alm. dry	n	
9	,, 16	x	5	748.0	—	1	st. moist	n	
9	,, 12	x	2	752.5	1	—	app. unch.	n	
9	,, 13	x	-1	748.4	1	—	dry	n	
10	,, 16	x	5	748.0	—	1	st. moist	n	

NOTE.—Number of experiments 36.
p means positive : n means negative.
x.—sputum was exposed to sun as long as any available.
At sunset, Petri dish was closed and stored in cool place.
Next morning it was again exposed to the sun for required number of hours.
app. unch.—means apparently unchanged.
Therm. readings are average, always Centigrade.
Barometer readings also average.

TABLE 2. EXPOSURE OF SPUTUM TO DIFFUSED DAYLIGHT.

The covers of the Petri dishes containing sputum were separated from the lower dish by wire and the whole left on the windowsill of a room. Room was either heated to av. temp. of 10 C. or left cold.

Hrs. expd.	*Date.*	*Time.*	*Rm. heated.*	*Rm. unhtd.*	*Outs.T.*	*Barom.*	*Cond. sput.*	*Cult. P.*
7	Mch. 11	11-6	1	—	-8	752.4	dry	p
8	Ap. 2	11-7	1	—	4	749.2	st. moist	p
12	,, 2	11-11	1	—	4	749.2	,,	p
14	Mch. 9	8a-10p	1	—	-8	754.0	,,	n
23	Ap. 2	11a-10a	1	—	4	749.2	dry	p
24	Mch. 11	11a-11a	1	—	-8	752.4	dry	n
24	Ap. 6	,,	1	—	-1	752.5	dry	n
24	,, 7	,,	—	1	-1	749.8	app. unch.	p
30	Mch. 11	11a-6p nxt. day.	1	—	-9	752.4	dry	n
48	Ap. 6	11a-11a	1	—	-1	749.6	dry	p
48	,, 7	x	—	1	-1	748.2	app. unch.	p
96	,, 7	x	—	1	3	746.7	dry	n

NOTE.—x.... .means time continued until next day or days.
12 experiments were made.

TABLE 3. EXPOSURE OF SPUTUM TO ARTIFICAL COLD.

Plague sputum was collected in covered Petri dishes and secured in round tins, which were then placed in a biscuit box and placed in the ice-cellar.

Days expd.	*Date begun*	*Date finshd.*	*Cond. sputum*	*Culture P.*	*Remarks.*
26	Mch. 15	Ap. 10	App. unch.	p	
33	Ap. 26	May 29	,,	n	
33	,,	,,	,,	p	
33	,,	,,	,,	n ?	
33	,,	,,	,,	p	
33	,,	,,	,,	n	
40	Feb. 14.	Mch. 26	,,	p	
69	,,	Ap. 24	,,	p	
69	,,	,,	,,	p	
99	Ap. 26	Aug. 3	Alm. dry	p	During the warmer period (June 1-Aug. 31) sputum was kept in cold storage room (T.—3C).
99	,,	,,	,,	n	
208	,,	Nov. 20	,,	n	

TABLE 4. EXPOSURE OF SPUTUM ON WOOD AND GAUZE.

Pieces of wood and gauze with plague sputum were placed in Petri dishes in the shady corners of a slightly heated room (T. 10 C.) The dishes were uncovered in the series March 5 and 11. In those of March 11, they were covered with white sterile gauze.

Hrs. expd.	*Date begun*		*Gauze*	*Wood*	*Outs. Temp.*	*Baron.*	*Cond. sput.*	*Cult. B. P.*	*Remarks.*
24	Mch.	5	1	—	-8	748.7	dry	p	
24	,,	5	—	1	-8	748.7	dry	p	
30	,,	11	1	—	-9	752.4	dry	n	
30	,,	17	1	—	-5	747.2	dry	p	
30	,,	11	—	1	-9	752.4	dry	n	
30	,,	17	—	1	-5	747.2	dry	p	
48	,,	5	1	—	-7	748.0	dry	n	
48	,,	11	1	—	-10	751.1	dry	p	
48	,,	17	1	—	-3	745.6	dry	p	
48	,,	29	1	—	-4	748.8	alm. dry	p	few.
48	,,	5	—	1	-7	748.0	dry	n	
48	,,	11	—	1	-10	751.1	dry	n	
48	,,	17	—	1	-3	745.6	dry	p	
48	,,	29	—	1	-4	748.8	alm. dry	p	
54	,,	29	1	—	-4	748.8	alm. dry	p	
54	,,	29	—	1	-4	748.8	alm. dry	n	
70	,,	29	1	—	-1	747.8	dry	p	few.
70	,,	29	—	1	-1	747.8	dry	p	one col.
72	,,	29	1	—	-1	747.8	dry	p	few.
72	,,	29	—	1	-1	747.8	dry	p	
96	Ap.	7	1	—	-5	747.2	dry	n	
96	,,	7	—	1	-5	747.2	dry	n	contam.

NOTE.—22 examinations were made altogether.

TABLE 5. PLAGUE SPUTUM DEPOSITED UPON EARTH.

Plague sputum was deposited upon fresh earth in Petri dishes and placed in the shady corner of a slightly heated room (mean T. 10C.) Petri dishes covered in earlier exps, in later ones some were covered with pieces of sterile gauze, others with lid.

Hrs. expd.	*Date.*		*Outs. Temp.*	*Baron.*	*Cond. sputum.*	*Cult. B. P.*	*Remarks.*
1	Ap.	9	7	746.6	—	p	few. Lid closed.
2	Mch.	12	-10	752.2	—	n	
2	Ap.	9	7	746.6	—	n	lid closed.
4	Mch.	11	-9	752.4	dry	n	
6	Ap.	12	-13	739.2	—	p	few
7	Mch.	11	-9	752.4	dry	n	
7	Ap.	15	-5	748.5	—	p	
8	Mch.	9	-8	754.0	dry	n	
24	Mch.	5-6	-8	748.7	dry	n	

NOTE.—Altogether 9 experiments were made.

TABLE 6. PLAGUE SPUTUM COVERED BY EARTH.

Sputum was placed in Petri dishes and covered with earth, either fresh or partially sterilised. Dishes were closed in series of March 14. and of April 9., and covered with white paper in the later series. These exps. were done in our main laboratory (Temp. 17 C.)

Hrs. expd.	*Date.*	*Earth fresh.*	*Earth sterild.*	*Barom.*	*Cult. B.P.*	*Remarks.*
½	Mch. 21	1	—	743.7	p	few
½	,, 21	—	1	743.7	p	×
1	,, 14	1	—	748.3	n	
1	,, 14	—	1	748.3	n	
1	,, 18	1	—	748.4	?	
1	,, 18	—	1	748.4	p	
1	,, 21	1	—	743.7	p	few
1	,, 21	—	1	743.7	p	×
1	,, 29	1	—	747.4	p	few
1	,, 29	—	1	747.4	p	
2	,, 29	1	—	747.4	p	few
2	,, 29	—	1	747.4	p	
3	,, 14	1	—	748.3	n	
3	,, 14	—	1	748.3	n	
3	Ap. 9	1	—	746.6	p	few
4	,, 9	1	—	746.6	p	,,
5	,, 13	1	—	733.2	p	,,
6	,, 17	1	—	744.6	p	,,
12	,, 24	1	—	746.7	p	

Note.—Altogether 19 exps. were made with only 4 negatives.

x......Earth was almost sterile, only a few non-spore-bearing colonies growing in controls.

TABLE 7. PLAGUE SPUTUM MIXED WITH EARTH

Sputum was mixed with earth. Technique as in Table 6.

Hrs. expd.	*Date.*	*Earth fresh.*	*Earth ptly. sterilsd.*	*Barom.*	*Cult. B. P.*	*Remarks.*
1	Mch. 14	1	—	748.3	p	
1	,, 14	—	1	748.3	p ?	
1	,, 18	1	—	748.4	n	
1	,, 18	—	1	748.4	n	
2	,, 18	1	—	748.4	p	
2	,, 21	1	—	743.7	p	
2	,, 21	—	1	743.7	p	
3	,, 14	1	—	748.3	n	
3	,, 14	—	1	748.3	n	
3	,, 18	1	—	748.4	p	few
3	,, 18	—	1	748.4	n	
3	,, 21	1	—	743.7	p	
3	,, 21	—	1	743.7	p	
3	,, 29	1	—	747.4	p	,,
3	,, 29	—	1	747.4	p	,,
4	,, 18	—	1	748.4	p	,,
4	,, 21	1	—	743.7	p	
4	,, 21	—	1	743.7	p	
4	,, 29	1	—	747.4	p	,,
4	,, 29	—	1	747.4	p	
5	,, 29	1	—	747.4	p	,,
5	,, 29	—	1	747.4	p	,,
6	,, 29	1	—	747.4	p	,,
6	,, 29	—	1	747.4	p	,,

Note—24 experiments were done with only 4 negatives.

TABLE 8. ACTION OF LIQUID DISINFECTANTS.

The sputum was subjected to the action of solutions of different disinfectants in varying strengths. For technique see text.

Disinfect.	*Sol.*	*30 min.*	*20 min.*	*10 min.*	*5 min.*
Ac. Carbol.	1 :10	—	—	n(1)	n(1)
	1 :20	?(5)	?(5)	?(6)	?(10)
	1 :40	?(7)	?(7)	p(7)	p(3)
	1 :80	p(5)	p(5)	p(4)	p(3)
Hyd. Perchl.	1 :500	—	n(2)	p(2)	p(2)
	1 :1000	n(3)	?(5)	?(5)	p(4)
	1 :2000	n(3)	?(4)	p(5)	p(4)
	1 :4000	p(4)	p(3)	p(4)	p(4)
Lysol.	1 :50	n(4)	n(4)	?(4)	?(3)
	1 :100	p(5)	?(5) ×	p(5)	p(5)
	1 :200	p(4)	p(4)	p(4)	p(4)
	1 :400	p(5)	p(4)	p(4)	p(4)
Phenoid	1 :50	?(4)	p(4)	?(3)	p(3)
	1 :100	p(3)	p(3)	p(3)	?(3)
	1 :200	p(3)	p(3)	p(3)	p(3)
	1 :400	p(3)	p(3)	p(3)	p(3)
Pot. Permang.	1 :500	?(3)	p(3)	p(3)	p(3)
	1 :1000	p(1)	p(1)	p(1)	p(1)
	1 :2000	p(1)	p(1)	?(1)	p(1)
	1 :4000	p(1)	p(1)	p(1)	p(1)
Hydrogen.	1 :3	p(1)	p(1)	n(1)	p(1)
Peroxide	1 :5	p(1)	p(1)	p(1)	p(1)
	1 :10	p(1)	p(1)	p(1)	p(1)
Izal.	1 :50	?(2)	?(2)	?(2)	?(2)
	1 :100	?(2)	p(2)	p(3)	p(3)
	1 :200	p(1)	p(1)	p(1)	p(1)
	1 :400	p(1)	p(1)	p(1)	p(1)
Lysoform	1 :50	p(1)	p(1)	p(1)	?(2)
	1 :100	p(1)	p(1)	p(1)	p(2)
	1 :200	p(1)	p(1)	p(1)	p(1)
	1 :400	p(1)	p(1)	p(1)	p(1)
Antiform.	1 :10	p(1)	?(1)	p(1)	p(1)
	1 :20	?(2)	p(2)	p(2)	?(2)
	1 :40	p(2)	p(2)	p(2)	p(2)
	1 :80	p(2)	p(2)	p(2)	p(2)

Explanation.—p means growth obtd. in all or majority of exps.
n ,, no growth obtd. in exps.
? ,, growth obtd. in minority of exps., the rest being sterile or contaminated.
figure in bracket means number of exps. performed.
× means positive result obtd. in animal experiment.

TABLE 9. ACTION OF ALCOHOL AND LIME.

Time mins.	*Alcohol conc.*	*Alcohol dild* ½	*Lime- water* 1 :10	*Slaked lime*
30m.	n(1)	p(1)	n(1)	n(2)
20m.	n(1)	p(1)	n(3)	?(3)
10m.	n(1)	p(1)	?(4)	?(3)
5m.	n(1)	p(1)	?(4)	?(3)
4	n(3)	p(1)	p(3)	?(2)
3	p(10)	p(1)	?(3)	n(2)
2	p(10)	p(1)	p(2)	n(2)
1	p(2)	p(1)	?(2)	n(2)
½	p(1)	p(1)	—	—

NOTE.—Absolute alcohol and conc. methylated spirit gave same results.
Signs same as in Table 8.

TABLE 10. ACTION OF LIME.

Plague sputum was placed in Petri dishes either on slaked lime or covered with it. Exps. done in laboratory (Temp. 17 C.).

Hrs. expd.	*Date.*	*Placed on lime.*	*Covered with lime.*	*Barom.*	*Cult. B. P.*
¼	Ap. 24	—	1	746.7	n?
½	,, 24	—	1	746.7	n
1	,, 17	—	1	744.6	n
2	,, 17	1	—	744.6	p?
4½	,, 13	1	—	733.2	n
5	,, 13	—	1	733.2	n

TABLE 11 FEEDING EXPERIMENTS WITH PLAGUE SPUTUM.

Two sets of animals, each consisting of one rabbit and one gp, were fed with plague sputum mixed with ordinary vegetable food.

Days fed.	*Date begun.*	*Date finished.*	*Died.*	*PM. result*
3	Ap. 11	Ap. 13	Ap. 14	no plague.
5	,, 24	,, 28	May 13	,,

NOTE.—One rabbit and one gp. survived.

TABLE 12. EXPERIMENTS UPON COUGHING.

Plague patients were allowed to cough on agar plates held perpendicularly and directly in front of their mouth at varying distances.

Date.	*Outs. T.*	*Barom.*	*P. ward.*	*Open air.*	*Result P. Distance in feet.* ½	1	2	3	4	5	6
Mch. 7	-4	747.5	1	—	—	—	n?	n	—	n	n
,, 8	-5	748.7	—	1	—	—	n	n	—	n	n
,, 8	-5	748.7	1	—	—	—	—	—	—	n	—
,, 9	-8	754.0	—	1	—	—	n	—	n	?	—
,, 29	-4	747.4	—	1	p	p	—	—	—	—	—
Ap. 2	-4	749.2	—	1	p	p	p	?	—	—	—
,, 5	-1	750.3	—	1	—	n	n	?	n	—	—

TABLE 13. INFECTIVITY OF SICK ROOMS. AGAR PLATES.

Uncovered agar plates were placed in the sick rooms of plague patients at heights of 1 ft., 3 ft. and 6 ft. as far away from patient as possible (not in direct line of breath.) Room 10 by 10 by 10 ft.

Hrs. expd.	*Date*	*Barom.*	*Culture B.P.*	*Remarks.*
½	Feb. 28	747.9	n	
½	,, 28	747.9	n	×
½	Mch. 3	747.0	n	
½	,, 4	748.6	n	
1	,, 13	748.4	n	

×......Room chosen where one patient had died and been removed an hour before. Plates were placed on floor, bed and windowsills.

TABLE 14. INFECTIVITY OF SICK ROOMS ANIMALS.

Gps. and rabbits were placed in rooms where plague patients were dying or had died immediately before. Animals were kept in pairs in tin buckets (diam, 11 in. and ht. 11½ in.) placed on floor. At stipulated times the pairs were removed from room. Exp. of Feb. 20. was performed in steam-heated main building (T. 17) in a room 12 by 12 by 10 with one outside window; the others were in plague wards.

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a. GENERAL TABULATIONS.

Date begun.		½ *b.d.*	½	1	2	3	4	6	12	24	84	96 *hrs.*
Feb.	20	1	a	a	1	1	b	—	—	—	—	—
Mch	2	1	a	1	1	—	—	—	—	—	—	—
,,	21	1	1	1	1	—	—	—	—	—	—	—
Ap.	5	—	—	—	—	—	—	—	—	—	—	c
,,	7	—	—	—	—	1	—	1	1	1	—	—
,,	12	—	—	—	—	—	—	—	—	—	—	d
,,	21	—	—	—	—	—	—	—	—	—	e	—

Explanation.—½ b.d. means ½ hr. before death. All others after death Pt.
a means death of one of the pair.
b ,, . ,, both.
c These gps. (4) were killed by a Russian colleague to whom they belonged.
d two gps. and two rabbits exposed.
e rat exposed.

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b. TABLE OF POSTMORTEMS.

Hrs. expd	*Date expos.*	*An. died*	*Interv.*	*Result P.*	*Bact. findings.*
½	Feb. 20	Feb. 27	7 days	p	*smears* ht, lg, sp. pos. *cult.* lung pos.
½	Mch. 2	Mch. 17	15 ,,	p	*smears* ht, lg, sp. neg. *cult.* lg neg.; ht, sp. pos.
1	Feb. 20	Feb. 24	4 ,,	p	*smears* ht, neg., sp. pos. *cult.* all pos.
4	,, 20	,, 25	5 ,,	p	*smears* ht, sp. pos. *cult.* all pos.
4	,, 20	,, 25	5 ,,	n	
84	Ap. 21	May 1	7-10 ,,	n	(rat used.)
96	,, 5	Ap. 9	4 ,,	p	other 3 gps. showed no sign P.

TABLE 15 ACTION OF FORMALIN GAS AND SULPHUR FUMES.

Plague sputum in open Petri dishes was exposed in an unheated room (10 by 10 by 10) to formalin gas or sulphur fumes. Formalin gas was generated with 400 g. formalin, 200 g. Permang. and 200 g. water. Sulphur (2 lbs. for each 1000 c ft.) was burnt in earthenware bowl surrounded with water in basin. Walls and floor moistened with water. Windows sealed by paper.

Hrs. expd.	*Date.*	*F. gas.*	*S. fumes.*	*Outs. T.*	*Barom.*	*Cond. sputum.*	*Cult. P.*	*Remarks.*
4	Ap. 1	1	—	7	744.5	—	p	
4	,, 1	—	1	7	744.5	—	p	
12	,, 14	1	—	6	735.1	app. unch.	p	
12	,, 16	1	—	4	744.9	,,	p	few
12	,, 14	—	1	6	735.1	st. moist.	n	
12	,, 16	—	1	4	744.9	dry	n ?	
12	,, 16	—	1	4	744.9	,,	n	
15	,, 10	1	—	8	743.8	alm. dry	p	
15	,, 10	—	1	8	743.8	,,	n	contam.
18	,, 18	—	1	7	744.5	st. moist.	n	
20	,, 6	1	—	-1	751.1	alm. dry	?	
20	,, 9	1	—	8	745.9	,,	p	
20	,, 6	—	1	-1	751.1	dry	n	contam.
20	,, 9	—	1	8	745.9	alm.. dry	n	
20	,, 9	—	1	8	745.9	,,	n ?	contam.
23	,, 8	1	—	5	746.6	—	n	
23	,, 26	—	1	7	748.2	dry	n	
24	,, 14	1	—	6	741.8	app. unch.	n	
24	,, 18	1	—	7	744.5	st. moist	n	
24	,, 18	1	—	7	744.5	alm. dry	p	few
24	,, 24	1	—	8	744.3	dry	p	few
24	,, 24	1	—	8	744.3	,,	n	
24	,, 24	1	—	8	744.3	,,	p	few
24	,, 25	1	—	8	746.0	,,	p ?	
24	,, 25	1	—	8	746.0	,,	n	
24	,, 25	1	—	8	746.0	,,	n	
24	,, 30	1	—	11	750.0	,,	n	
24	,, 30	1	—	11	750.0	,,	n	
24	,, 14	—	1	6	741.8	st. moist	n	
24	,, 18	—	1	7	744.5	,,	n ?	
24	,, 20	—	1	7	744.8	dry	?	
24	,, 20	—	1	7	744.8	,,	n	
24	,, 20	—	1	7	744.8	,,	n	
24	,, 21	—	1	10	746.6	alm. dry	?	
24	,, 21	—	1	10	740.6	dry	?	
24	,, 21	—	1	10	740.6	,,	n	

NOTE.—36 exps were made altogether.

TABLE 16 EXAMINATION OF PLAGUE INFECTED CLOTHING.

Pieces of cloth cut from the external coats of plague corpses were gently stroked on agar plates. Care was taken not to employ any visible sputum-soiled cloth.

Hrs. dead.	*Date.*	*Outs. T.*	*Barom.*	*Coat front.*	*Coat back.*	*Cult P.*	*Remarks.*
2	Ap. 2	4	749.2	1	—	p	few
4	,, 7	-1	749.8	1	—	p	few
4	,, 7	-1	749.8	1	—	p	few
4	,, 7	-1	749.8	1	—	p	few
4	,, 7	-1	749.8	1	—	n ?	contam.
4	,, 13	12	733.2	1	—	p	
4	,, 13	12	733.2	—	1	p	
4	,, 13	12	733.2	1	—	p	few
4	,, 13	12	733.2	—	1	n	
4	,, 17	4	744.6	1	—	n	
4	,, 17	4	744.6	—	1	?	
4	,, 17	4	744.6	1	—	p ?	
4	,, 17	4	744.6	—	1	p	few
6	,, 24	7	745.7	1	—	p	few
6	,, 24	7	746.7	—	1	p ?	
24	,, 9	5	746.6	1	—	p	few
24	,, 9	5	746.6	—	1	p	few
24	,, 9	5	746.6	1	—	p	few
24	,, 9	5	746.6	—	1	p ?	
24	,, 9	5	746.6	1	—	p	few
?	Mch. 5	-8	747.9	1	—	p	
?	,, 12	-10	752.5	1	—	n	
?	,, 16	-7	748.0	1	—	n	
?	,, 21	- 6	743.7	1	—	n	x
?	May 9	14	741.5	1	—	n	
?	,, 9	14	741.5	—	1	n	
?	,, 14	13	744.6	1	—	p ?	
?	,, 14	13	744.6	—	1	n	
?	,, 14	13	744.6	1	—	n	y
?	,, 14	13	744.6	—	1	n	y

Note.—Altogether 30 experiments were made.

x.—Another piece of same coat soiled with visible dry sputum was negative.

y.—Animal exps. proved negative.

TABLE 17. ANIMALS EXPERIMENTS WITH INFECTED CLOTHING.

Sets of two gps. and two rabbits were kept in new coffins (partially closed), where outer clothes recently removed from dead were placed

Hrs. expd.	*Date begun.*	*Date finished*	*Anim. died.*	*Result P.*	*Remarks.*
12	Ap. 26	Ap. 26	May 5(R)	n	
24	,, 26	,, 27	—	—	Alive
24	,, 28	,, 29	May 25(R)	n	
72	May 20	May 23	,, 23(R. Gp.)	n	x
144	Ap. 28	,, 4	,, 18(R)	n	y

Note.—xy.—clothes were replaced by another set after 2 and 4 days resp.

TABLE 18. EXPERIMENTS WITH PAPER MONEY AND COIN OF PL. CASES.

Technique was same as in Table 16. Cultivations much contaminated.

Date.	*Paper money.*	*Silver coin.*	*Cult. P.*	*Remarks.*
Ap. 13	1	—	n	
,, 13	1	—	?	
,, 17	1	—	n	
,, 17	1	—	n	
,, 24	—	1	n	x
,, 25	1	—	n	
,, 25	1	—	n	
,, 27	1	—	n	y

Note.—x. Plentiful non-plague colonies obtd. Two controls done with silver coins of healthy persons showed fewer cols.
y. rabbit inoculated with emulsion remained healthy.

TABLE 19. ANIMAL EXPERIMENTS WITH URINE OF PLAGUE. CASES :

2 c.c of urine from plague cases were injected subs. into gps.

Date.	*Sick.*	*Dead.*	*Anim. died.*	*Cult. P.*	Remarks.
Ap. 24	1	—	n	—	survived.
,, 24	—	1	n	—	,,

TABLE 20. OBSERVATIONS UPON CONTACTS AND PLAGUE CARRIERS.

Contacts immediately after admission were investigated for carriers.

Case No.	*Date.*		*Sputum.*	*Tonsil.*	*Res. P.*	*Date anim. exp.*	*Anim. d.*	*Res. P.*	*Remarks.*
2	Feb.	2	1	—	p	Feb. 7	Feb. 8	p	pos. case
2	,,	6	1	—	p	,, 13	,, 14	p	
2	,,	6	—	1	p	—	—	—	
123	Mch.	1	1	—	n	—	—	—	
126	,,	2	1	—	n	—	—	—	
141	,,	4	1	—	p	Mch. 6	Mch. 7	p	pos. case
141	,,	—	—	—	—	,, 8	,, 9	p	x
141	,,	9	1	—	n	—	—	—	
141	,,	9	—	1	n	—	—	—	
141	,,	13	—	1	n	—	—		
141	,,	18	—	—	—	—	—	—	y
142	,,	4	1	—	n	—	—	—	
143	,,	4	1	—	n	—	—	—	
144	,,	4	1	—	?	Mch. 6	Mch. 10	n	
191	,,	14	1	—	n	—	—	—	
192	,,	14	1	—	?	Mch. 19	—	n	
192	,,	19	1	—	n	—	—	—	
193	,,	14	1	—	n	—	—	—	
194	,,	14	1	—	n	—	—	—	
195	,,	14	1	—	?	Mch. 19	—	n	
195	,,	19	1	—	n	—	—	—	
196	,,	14	1	—	n	—	—	—	
209	,,	22	1	—	n	—	—	—	
210	,,	22	1	—	n	—	—	—	
215	,,	26	1	—	p	—	—	—	z
220	,,	28	1	—	n	—	—	—	
220	,,	30	1	—	n	—	—	—	
221	,,	28	1	—	n	—	—	—	
222	,,	28	1	—	n	—	—	—	
223	,,	28	1	—	n	—	—	—	
223	,,	30	1	—	n	—	—	—	
226	,,	30	1	—	n	—	—	—	
227	,,	30	1	—	n	—	—	—	
228	,,	30	1	—	?	—	—	—	
228	Ap.	2	1	—	n	—	—	—	

NOTE.—35 examinations were made, 30 upon sputum and 3 upon tonsils.
x.—An emulsion of ht. culture (March 7) was injected.
y.—Serum of this case 1 :50 did not agglutinate B. P.
z.—not counted as carrier because case developed P. soon after

TABLE 21. EXPERIMENTS WITH PROTECTIVE MASKS.

Cultures were taken from (a) outer layer of gauze, (b) outer layer cotton wool and (c) inner layer cotton wool of masks acttually worn in plague wards.

Hrs. expsd.	*Date.*	*(a)*	*(b)*	*(c)*	*Outs. T.*	*Barom.*	*Cult. B. P.*
½	Mch. 3	1	—	—	-11	747.0	n
½	,, 3	—	1	—	-11	747.0	n
½	,, 3	—	—	1	-11	747.0	n
3	,, 3	1	—	—	-11	747.0	n
3	,, 3	—	1	—	-11	747.0	n
3	,, 3	—	—	1	-11	747.0	n
3	,, 5	1	—	—	-8	747.9	p
3	,, 5	—	1	—	-8	747.9	n
3	,, 5	—	—	1	-8	747.9	n
3	,, 9	1	—	—	-8	754.0	n
3	,, 9	—	1	—	-8	754.0	n
3	,, 9	—	—	1	-8	754.0	n
4	,, 12	1	—	—	-10	752.5	n
4	,, 12	—	1	—	-10	752.5	n
4	,, 12	—	—	1	-10	752.5	n

TABLE 22. EXPERIMENTS WITH MIXED INFECTION.

Series I and II (B. Pestis, with B. subtilis (S) or with spore-bearing bacillus (H).)

Anim.	*Date Inf.*	*Date Death.*	*Protocol.*
Gp I	17/III	18/3 (15 h)	Recd intrap 1cc BP and 1cc BH. *S.* neg. *C.* Ht ster; Sp & Pe, BH.
Gp K	24/III	26/3 (50 h)	Recd intrap 1cc BH on 22/III, then 1cc BP and 1cc BH. At pm perit abs. *S.* Ht & Bl neg. Sp & Abs, BP. Pe cavity, BP & BH. *C.* Ht, BP. Sp, BH. Pe, BP and BH.
Gp M	21/III	27/3 (144 h)	Recd intrap 1cc BP and 1cc BH. At pm perit. abs. *S.* Ht neg. Pe, BP. *C.* Ht & Pe, BP & BH.
Gp O	24/III	27/3 (72 h)	Recd intrap 1cc BS on 22/III, then 1cc BP & 1cc BS. At pm perit. abs. *S.* Ht & Abs, BP. *C.* Ht & Abs, BP & BS.
Gp P	1/IV	5/4 (120 H)	Recd subc 1cc Bs daily 25-31/III, then 1cc BP & 1cc BS. on back. At pm perit. abs. *S* Ht, ?BP. Sp, BP. *C.* Ht, BP. Sp & Pe, BP & BS.
Gp R 109	27/3/22	31/3 (96 h)	Recd subc on back 1/5 cc 9 day *C* BP & BS. At pm Sp covered by pus. *S.* Sp, BS & ?BP. *C.* Ht ster. Lv & Sp, BS & BP.

TABLE 23. EXPERIMENTS WITH MIXED INFECTION.

Series III. (B. Pestis with B. Pyocyaneus (B. Py.)).

Anim.	*Date Inf.*	*Date Death.*	*Protocol.*
R45	20/9	21/9 (24 h)	Recd subc whole slant bronch *C* from T12 plus 1p BP. At pm, congest Lyx and Tr. Haem Lg. Subc abs inguin. rg. *S.* pos BP. *C.* Ht & Lg ster. Inguin. Abs BP impure.
R46	13/9	22/9 (9 d)	Recd subc whole slant trach *C* from T12. Survived for 9 days and then used for another exp. At pm, big subc abs abdomen. TB nodules in lungs, confirmed histol.
R44	13/9	19/9 (6 d)	Recd subc whole slant feces *C* from T12 At pm, no apparent macros changes. *S.* some BP-like in all organs. *C.* Ht & Lg ster. Trach contam.
R47	23/9	25/9 (2 d)	Recd subc whole slant subcult from T12. At pm, perit abs & subc abs in chest. *S.* some BP in all organs. *C.* Ht BP impure. Perit & subc abs. BP & Py. Lg ?BP & Py.
R49	3/10	8/10 (5 d)	Recd subc on back 2 loops feces subcult from T12. At pm, abscess site inject. Early peritonitis near liver. Abs kidney. ?Rt pneum. *S.* some BP in all organs. *C.* Ht ster. Lg BP imp. Blad, Perit, Feces, Pus BP & Py.
R58	3/10	1/11 (29 d)	Recd subc 1 loop Lg culture from T12. At pm, Sp cong. *S.* Ht, Sp, Lg some BP-like. *C.* Ht ster. Sp ?B.P Histol. some bipol Bp-like in Sp.
R48	3/10	4/10 (24 h)	Recd subc on back 2 loops trach subcult from T12. At pm, oedema rt subcut abdomen. *S.* some BP in all organs. *C.* some BP imp in all organs.
R59	4/10	2/11 (29 d)	Recd subc on back ¼ loop subcult trach from T12. At pm, abs pelvis (?vagina). *S.* Ht & Sp some BP. *C.* Ht ster. Sp BP imp.
R63	12/10	19/11 (38 d)	Recd ½ loop subc trach subcult from T12. Survived 32 days, then used for another exp.
R62	12/10	18/11 (37 d)	Recd subc ½ loop trach subcult from T12. Survived 30 days, then used for another exp.
R57	12/10	1/11 (20 d)	Recd subc ¾ loop trach subcult from T12. At pm, Lg & Lv cong. Sp enlarged and full of nodules. *S.* Ht & Lg ?BP. Sp & Perit some BP. *C.* Ht, BP imp. Sp ster.
R65	8/11	21/11 (13 d)	Recd subc 1½ loops Py (isold from T12 and still containing some BP.)

			At pm, Lg petech. Lv fatty d. Sp. sw. with miliary nodules. S. Some BP-like in all organs. C. Ht ster. Sp contam. Lv some Bp-like imp.
R60	8/11	13/11 (5 d)	Recd subc 1½ loops trach subcult from T12. At pm, Lv fatty d. Sp acute sw. S. some Bp-like in all organs. C. No BP.
R90	9/2/22	12/2 (3 d)	Recd subc 1cc bouillon subcult trach from T12 plus 1cc BP. At pm, oedema in subcut. tissue chest. Small abs Lv. Sp acute sw. S. Lv some BP. Other organs ?BP. C. Ht, Sp, Lv some BP & plentiful Py. Control R92 inocd with BP alone died in 4 days.
R100	5/3/22	6/3 (27 h)	Recd 1cc of 24 h cult of Py and BP subc. At pm, ?Rt pneum. Sp acute sw. S. Ht. ?BP. Sp some BP. Lv BP & Py. C. Ht ster. Lv & Sp, Pyoc & some BP. Control R101 inocd with BP alone died in 4 days. Control R inocd with Py alone survived.

TABLE 24. EXPERIMENTS WITH MIXED INFECTION :

Series IV. (B. Pestis with B. acid. lact. BL.)

Anim.	*Date Inf.*	*Date Death.*	*Protocol.*
R108	27/3/22	31/3 (4 d)	Recd subc 1/5cc of 5 day culture BP & BL mixed milk. At pm, Lg cong esp. in rt lower lobe. Lv cong and fatty d. S. some BP and BL. C Ht & Lv plenty BP some BL. Control R110 inocd with BP in milk alone died in 6 days.

TABLE 25, EXPERIMENTS WITH PYOCYANEUS VACCINE (Py V).

Anim.	*Date Inf.*	*Date Death.*	*Protocol.*
CR	23-25/2/22	Surv.	Recd subc on 3 days Py V preserved in ½% Ac. Carbol. Survived.
R97	23/2/22	26/2 (3 d)	Recd subc 1 loop BP (control). At pm, pos. P.
R98	23/2/22	28/2 (5 d)	Recd subc 1 loop BP mixed with 2½cc PyV preserved as above); on 2 foll days 2cc PyV daily. At pm, Sp ac sw. Lv fatty d. S Sp shows BP. C. Sp, Lv, Ht, BP imp.
R104	8/3/22	12/3 (4 d)	2 loops of Recd subc 2 day BP cult grown in fresh PyV (no carbol) At pm, animal pregnant. No appar. changes. C. Ht, Lv, Ut, BP imp. Fetus sterile.
R105	8/3/22	12/3 (4 d)	Recd subc 2 loops of BP cult grown in fresh PyV (another sample, no carbol) At pm, pos BP.

TABLE 26. EXPERIMENTS WITH ADRENALIN MIXED WITH VACCINE OR SERUM.

Anim.	*Date Inj.*	*Date Death.*	*Protocol.*
R96	14/11	18/11 (4½ d)	Recd subc 1/6 slant BP (control). At pm pos P.
R95	14/11	18/11 (4 d)	Recd subc 1/6 slant BP, and on 3 foll days 1, 2 & 2cc anti-pest vaccine. At pm Sp soft & sw. Lv fatty d. *S.* Ht ?BP. Lv & Sp. BP. *C.* Ht, Lv, Sp. BP.
R94	14/11	18/11 (3½ d)	Recd subc 1/6 slant BP, and on 3 foll days—1cc adrenalin followed after 20m by 1, 2, 2cc anti-pest vaccine. At pm, Sp acute sw. Lv fatty d. *S.* Ht, Sp, Lv BP. *C.* do.
R127	29/IV	4/IV (5 d)	Recd subc 1 lp BP, and on 4 foll days 1cc adrenalin and 1cc anti-pest serum. At pm, Rt lung cong. Sp sl sw. Lv fatty d. *C.* Ht, Sp, Lv BP.

TABLE 27. CASES OF NATURAL PLAGUE IN TARABAGANS.

Anim.	*Date Inj.*	*Date Death.*	*Protocol.*
TX	?	16-18/9/22	Materials from 3 dead tarabs found in Transbaikal. *S.* Bubo pos BP. Cultures obtained from these tarabs were sent to us in Harbin and proved pos for BP.
Gp X	20/9/22	23/9/22 (3 d)	Materials from this gp inocd in Transb. were sent to us in Harbin and showed BP in smears from spleen and bubo.
RT	11 & 14/10/22	17/10/22 (3-6 d)	Recd subc on 11/10 one loop of culture (a) from TX. *S.* Ht & Sp, ?BP. Reinj whole slt on 14/10. *C* both neg. BP.
Gp 50	11 & 14/10/22	17/10/22 (4-7 d)	Recd subc on 11/10 one loop of culture (b) from TX. Reinj whole slant on 14/10. At pm, visceral pleura petech. Lv cong, ? abs. Sp covd with pus, ac sw, ? abs. *S.* Sp, BP. Ht neg. *C.* Ht & Sp pos BP imp.
R53	18/10/22	22/10 (4 d)	Recd subc ¼cc blood from gp50. At pm, some pus at site inj. Lower pt tr cong. Visc. pleura petech. Rt lg ?pneum. Lv cong. Sp swollen. *S.* Some BP in all organs. *C* Ht neg. Sp & Lg ?BP. Trach some BP imp.

TABLE 28 DIAGRAM OF TAR A BAGAN EXPERIMENTS 1921.

Orig. Cult. Pneum. Case	Subcult. Pneum. Case	
T1 inhd 8/8: d 16/8 pos P Contacts: T2 exposed 8/8 T3 ,, 8/8 T13 ,, 15/8 T14 ,, 15/8	T4 inhd 8/8: died 13/8 pos BP	Contacts: T5 expd 8/8 T6 ,, 8/8 x T15 ,, 15/8 T16 ,, 15/8

means wire screen
—— ,, solid partition
x..animal k 1/9, ? P.

Orig. Cult. Pulm. Case	Subcult. Pulm. Case		Tarabagan Cultures
T7 iuhd 8/8: k. 25/8. P. Contacts: T8 expd 8/8: d 6 mos: P. T9 ,, ,, T17 ,, 1 /8 T18 ,, ,, : k 1/9: ? P.	T10 inhd 8/8 died 13/8 pos BP	Contacts: T11 expd 8/8: k 25/8: ? P. T12 ,, ,, d 12/9: P. T19 ,, 15/8 T20 ,, ,, d 6 mos: ?P.	T31 inhd 22/8: d 28/8: P T32 ,, ,, : d 29/8: P Contacts: T33 expd 22/8 T34 ,, ,, T35 ,, ,, T36 ,, ,, : k 6/9: ?P. T37 bron 4/9.

On March 11, 1922, surviving animals were placed together. More died.

T109 on 12/3: no P.
T105 ,, 12/4: ? P.
T132 ,, 11/5: ? P.
T138 ,, 15/5: no P.
T147 ,, 1/5: ? P.
T148 ,, 3/7: no P.

TABLE 29. DIAGRAM OF TARABAGAN EXPERIMENTS 1921.

No.	*Inhaled.*	*Date death.*	*Protocol.*
T1	8/8	16/8 (7½ d)	Recd orig. cult. from kidney pm 6. *PM.* Cerv and postph glds sw. Trach & bronch cong. some bl in br. Pneum. patches both lgs. Lv fatty d. Sp ac. sw. Stom. & intest. petech. *S* BP in all organs. *C.* Bronch BP imp. Ht BP imp. Control R inocd with BP died in 36 h.
T4	8/8	13/8 (4½ d)	Recd subcult from kidney pm 6. *PM.* Cerv. glds enlgd. Tongue & Epig small heam. Trachea cong. Lgs haem, no marked pneum. Perit haem. Spleen sw. *S.* BP in all organs. *C.* Ht & Lg, BP imp. Control R inocd with BP died in 40 h.

T7	8/8	25/8 (k. after 17 d)	Recd orig. cult. from spleen pm 34. *PM.* cerv. glds sw. & cong. Lyx & Tr. sl cong. Br mucus. Lgs cong with many abs. *S.* Ht, Lg & cerv gld, some BP. Br, Sp, Abs, neg. *C.* Lg some BP. Cerv gld & Br, BP imp. Control R inocd with BP died in 50 h.
T10	8/8	13/8 (5 d)	Recd subcut from spleen pm 34. *PM.* bloody froth nostrils. Cerv glds enlgd. Tongue haem. Tons, epig, tr, congest. Pink sputum in bronchi. Lg haem patches. Sp sw and cong. *S.* BP in all organs. *C.* BP imp in all organs. Control R inocd with BP died in 50 h.
T31	22/8	28/8 (6 d)	Recd orig. cult from heart T1. PM. cerv and br glds sw & congest. Epig & Tr haem. Tr red full of pink froth. Lgs haem, esp left U.L. Epicard haem. Liver fatty d. Sp acute sw. Oment haem. Upper jejunum cong. *S.* BP in all organs. *C.* Tr & Ht, BP imp. Control R inocd with BP died in 4½ d.
T32	22/8	29/8 (5½ d)	Recd orig. cult. from lung of T10. *PM.* cerv glds sw. Tr cong. full of bloody froth. Rt Lg haem, Left Lg cong. Lv fatty d. Sp acute sw. Intest sl cong. *S.* BP in all organs. *C.* Ht and Peric BP imp. Control inocd with BP died after 5½ d.

TABLE 30. RESULTS OF TARABAGAN CONTACTS, 1921.

No.	*Exposed.*	*Date death.*	*Protocol.*
T11	8/8	k 25/8 (17 d)	*PM.* nil macros. *S.* Ht some BP. Sp neg. *C.* Ht ster. Sp some BP imp.
T6	8/8	k 1/9	*PM.* one cerv gld sl cong. Oed glottis & Lgs (?narcosis). *S.* some BP-like in all organs. *C.* Ht & Lg ?BP. Trach BP-like imp. Rabbit inocd with trach cult still alive after 17 d.
T18	15/8	k 1/9 (16 d)	*PM.* Lgs cong (?narcosis). Sp sl cong. *S.* Some SP-like in all organs. *C.* Ht very few BP-like. Lg neg. Tr ?BP-like imp.
T36	22/8	k 6/9 (14 d)	*PM.* Cerv gld sw & cong. Bl froth nostrils, lyx, tr. Sl oed glottis (?narcosis). Spleen miliary yellow nodules. *S.* Some BP-like in all organs. *C.* Ht & Lg ster. Tr very few BP-like imp.

T12	8/8	died 12/9 (35 d)	*PM.* Cerv glds sw & cong. Tons sw & cong. Phx small abs. Lyx & Tr cong. with pink froth. Lgs alm black. Lv cong. Sp ac sw with 2 small abs. Mesent haem *S.* Some BP in all organs. *C.* Ht ster. Sp BP-like imp. Other organs BP mixed with plenty Pyocy. Anim exps with cultures recorded in Table 23.
T8	8/8	6/2/22 (6 mos)	*PM.* Left Lg haem patches. Rt Lg adherent to pericard. Pericarditis with fib-sanguin exud. Lv fatty d. Sp ac sw. Stom some bl contents. Mesent ? haem. *S.* Pericard, Lv, Sp, BP. *C.* Sp ster. Lv some BP-like imp. Peric BP. Several exps with rabbits and other tarabs by inhal and inject all positive.
T20	15/8	14/2/22 (6 mos)	*PM.* Emaciated. Thymus sl sw. Sp ac sw. *S* Ht neg. Sp & Lv some BP-like. *C.* Ht, Sp & Lv ster.
T105	?/8	12/3/22 (7 mos)	*PM.* Head bitten off by other tarabs. Nil macros. *S.* Ht & Sp neg. *C.* Sp ster. Ht & Lv staphy alb.
T115	?/8	12/4/22 (8 mos)	*PM.* Sp enlarged but no acute ch. *S.* Sp some BP-like. *C.* Ht, Sp & Lv ster. Feces ?BP-like imp. Rabbit inocd with feces cult neg. BP.
T132	?/8	11/5/22 (9 mos)	*PM.* Head bitten off by other tarabs. Lgs greyish. Left Lg hyperem areas. Epicardium small grey spot surrounded by hyperem zone. Lv fatty infil (?) Other organs app. normal. *S.* Lyx & Sp some BP-like (?). *C.* Ht contam. Sp & Lv ster. Alim canal neg. BP. Anim exp. with feces cult neg. BP.
T133	?/8	15/5/22 (9 mos)	*PM.* Lgs cong with scattered hyperem areas. *S.* Lgs & Sp neg. *C.* Ht, Lg & Sp ster. Stom & Ileum ?BP. Feces BP-like imp. Rabbit inocd with feces cult neg BP.

TABLE 31. DIAGRAM OF TARABAGAN EXPERIMENTS, 1922.

Subcult. peric. T8	Cult Spleen R102		Cult Spleen R103
T104 inhd 1/73:d 11/4:P. Contact: T124 expd 17/3:d 28/4:P	T117 inhd 17/3 died 13/4 pos P.	Contacts: T 112 expd 17/3:d 6/4: P. Ta „ „ : Tb „ „	T107 inhd 17/3:d 22/3:P. Contacts: Tc expd 17/3 Td „ „

TABLE 32. RESULTS WITH INHALED TARABAGANS, 1922.

No.	*Inhaled.*	*Date death*	*Protocol.*
T107	17/3	22/3 (5 d)	Recd 1910 strain BP passed th lgp & 3 rabbits. *PM.* Cerv tissues haem effusion. Cerv glds sw. & cong. Lyx haem effus. Lt lg 3 haem patches (?aspiration). Epicard petech. Lv fatty d. Sp enl. Stom petech. Ileum filled with bloody masses, no ulcer. Large intest and feces normal. *S.* Some BP in all organs. *C.* Ht, Lv & Ileum BP. Sp contam. Exps with Ht & Ileum cult pos BP. (Table 34).
T114	17/3	11/4 (25 d	Recd subcult pericard T8. *PM.* Rt Lg small haem patches. Sp acute cu. *C.* all organs BP imp. Exps with feces cult pos BP (Table 34).
T117	17/3	13/4 (27 d)	Recd cult Sp R102 (obtd from strain T8) *PM.* Lgs cong esp R.U.L. Pleura petech. Lv fatty d. *C.* Ht ster. Other organs BP imp. Exps with feces cult pos BP (Table 34).

TABLE 33. RESULTS OF TARABAGAN CONTACTS, 1922.

No.	*Exposed.*	*Date death.*	*Protocol.*
T112	17/3	6/4 (20 d)	*PM.* Cerv glds sw & cong. Lgs hyperem patches. Sp acute sw. *C.* All organs (exc urine cult neg; with feces cult pos (Table 34).
T124	17/3	28/4 (42 d)	*PM.* Lt Lg hyperem patch. Sp sl enl. *C.* All organs BP imp. Exps with cult from Lv, Stom & Ileum pos (Table 34).

TABLE 34. EXPERIMENTS WITH CULTURES FROM ALIM. TRACT OF TARABAGANS: 1922.

No.	*Inocul.*	*Date death*	*Protocol.*
R119	1/4 18/4	19/4 (?1-18 d)	Recd twice 2 loops ileum cult T107. *PM.* Lgs sl cong. Perit abs near Diaph. Sp enl. and studded with nodules. Mesent glds sw. *S.* Sp some BP-like.

			C. Ht, Lv, ster. Sp some BP imp. Rabbit 122 inocd with one loop Sp cult. died in 4 d of P.
R126	28/4	3/5 (5 d)	Recd 2 loops of ileum cult T107. *PM.* Sp ac sw. *S.* Some BP-like in Sp. *C.* Ht, Sp & Lv, bipolar unlike BP.
R130	4/5	9/5 (5 d)	Recd. 2 loops of ileum cult T107. *PM.* Lt Lg hyperem areas. Sp sl acute ch. *S.* ? BP in Sp. *C.* all neg.
R135	11/5	17/5 (6 d)	Recd 2 loops ileum subcult T107. *PM.* nil macros. *S.* Sp BP. *C.* Ht BP imp. Sp & Lv contam.
R116	8/4	13/4 (5 d)	Recd 1 loop feces cult T112. *PM.* Sp sl acute ch. *C.* Ht, Sp & Lv BP imp.
R118	12/4	14/4 (2 d)	Recd 2 loops feces cult T114. *PM.* Oed subcutis chet. Sp sl acute ch. *C.* Ht & Lv ster. Sp BP. Rabbit 121 inocd with 1 loop Sp cult died in 6 d of P.
R131	18/4 28/4	10/5 (12-22 d)	Recd 1 and 2 loops feces cult T115. *PM.* Lgs hyperem areas. Sp sl acute ch. *S.* Sp ?BP. *C.* All ster.
R120	18/4	22/4 (4 d)	Recd 1 loop feces cult T117. *PM.* Lgs cong. Lv & Sp covdwith pus. *C.* all BP pos.
R125	29/4	1/5 (2 d)	Recd 1 loop stomach cult T124. *PM.* Sp sl acute ch. *S.* Sp ?BP. *C.* Ht. Lv, ster. Sp BP imp. Rabbit 134 inocd with 2 loops Sp cult died in 8d of P.
R128	2/5	8/5 (6 d)	Recd 1 loop ileum cult T124. *PM.* Lgs hyperem areas. *S.* Sp BP. *C.* Ht & Lv BP.
R139	12/5	4/6 (23 d)	Recd 2 loops feces cult T132. *PM.* Perit abs near Lv. Mesent & Oment necrot nods. *S.* Ht neg. Sp & Perit ?BP. *C.* Ht & Sp ster. Lv ?BP. All 4 anim exps with Lv cult proved neg.
R136	16/5	18/5 (2 d)	Recd 2 loops feces cult T133. *PM.* Sp sl acute ch. *S.* Ht & Sp neg. *C.* ?BP in all organs. All five anim exps with cult proved neg.
R ?	27/5	—	Recd 3 loops feces cult T133. Remained healthy.

TABLE 35. FEEDING EXPERIMENTS WITH TARABAGANS, 1922.

Two sets of animals each consisting of one tarab and one rabbit were fed for five days with their usual food (beans and cabbage resp.) mixed for each animal with 25 cc virulent BP bouillon. Animals of first set received no fresh food on 6th and 7th days; on 8th day dishes were changed. In second set, dishes were changed on 6th day.

Anim.	*Feeding period*	*Date death.*	*Protocol.*
T ?	22-28/5	—	still healthy (1 month)
R138	22-28/5	30/5 (2-8 d)	BP positive in smears, cult & exps.
T146	12-16/6	1/7 (13-18 d)	*PM.* Cerv glds sw & cong. Lgs cong. with haem patches. Ileum bloody mucus, mucosa cong, no ulcer. *S.* Sp ?BP. Ileum BP. *C.* Ht, Lv & Sp ster. Stom & feces some BP. Ileum more BP.
R144	12-16/6	17/6 (1-5 d)	BP pos in smears, cult & exps.

P.S.—This animal died on July 29, 1922. P.M., showed enlarged and congested cerv. glands, marked congestion of resp. tract, meteorism of colon, haem. areas around lymph : glands in mesentery. Smears showed suspicious B.P. Cultures, Exp. from intest tract, looked suspicious, but no definite results so far have been obtained from animal exps. W.L.T. August 20, 1922.

TABLE 36. EXPERIMENTS UPON NON-SUSCEPTIBLE ANIMALS.

Date	*Pig*	*Duck*	*Chicken*	*Material Inj*	*Quantity*	*Survived*	*Remarks*
Ap. 29	1	—	—	Sp C (pm 22)	slant	14 d	Reinjd. 13/5
,, 29	1	—	—	,,	,,	,,	,,
,, 29	—	—	1	,,	½ slant	,,	,,
,, 29	—	—	1	,,	,,	,,	,,
,, 29	—	—	1	,,	,,	,,	,,
May 13	1	—	—	Fresh blood (pm 27	5 cc	1 year	a.
,, 13	1	—	—	,,	,,	,,	a.
,, 13	—	—	1	,,	2 cc	4 mos	b.
,, 13	—	—	1	,,	,,	,,	—
,, 13	—	—	1	,,	,,	,,	—
,, 28	—	1	—	Sp C (pm 33)	1/3 slt	,,	—
,, 28	—	1	—	,,	,,	,,	—
,, 28	—	1	—	,,	,,	,,	—

NOTE.—Altogether 2 pigs, 3 ducks and a chicken were exptd.

a.—abscess developed at site of inject. Pus showed no BP. May 18 and 22.

b.—haematoma developed at site of injection. Blood show no BP. May 18.

CLINICAL OBSERVATIONS UPON THE SECOND MANCHURIAN PLAGUE EPIDEMIC 1920-21.

CONTENTS.

I. Introduction. Symptoms and signs of the disease.

II. Note on the beginning and decline of the epidemic.

III. Observations on infectivity, epidemiology and incubation period.

IV. Notes on symptomatology and therapy.

I. INTRODUCTION. SYMPTOMS AND SIGNS OF THE DISEASE.

Our knowledge of pneumonic plague is based upon a series of outbreaks which have occurred in recent years. The Black Death which ravaged the whole of Europe and a large part of Asia might have been plague or a virulent type of influenza such as that encountered in 1918. The famous plague of London lasting from the sixteenth to the middle of the seventeenth century was mainly of the bubonic type. Among the annual plague outbreaks happening in India since 1896, some purely localised pneumonic epidemics have been encountered among the general bubonic type. The most prominent of these occurred at Kashmir, North India, in the cold season of 1903-1904 when 1443 cases were reported with 20 recoveries (all bubonic) towards the end of the epidemic. Two small epidemics have also been seen in the Gold Coast of Africa in 1908 and 1917.*

It was not until the first Manchurian outbreak occurred in 1910-11 with its huge toll of deaths (60,000) that the world's attention was riveted upon this most fatal of all infectious diseases. This Pneumonic Plague was carefully studied in all its aspect by Chinese, American and Japanese physicians at the time. The Shansi epidemic of 1917-18—also purely pneumonic in character and killing 16,000 persons—furthered our knowledge of the infection. The clinical features of Pneumonic Plague are thus described by Wu Lien Teh[1]:—

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* Two British missionary physicians, Drs. Lawson and Mackenzie died suddenly in June 1922 at Foochow (South China), probably of Pneumonic Plague. The former had attended a Chinese patient some days previously and developed the disease soon after. The second doctor attended his colleague and was himself infected 4 days afterwards. Bubonic plague is endemic in the city of Foochow.

Aetiology. Both sexes are equally susceptible and no person can withstand the disease once the organism enters the respiratory tract. Children are just as susceptible as adults, as evidenced by the Shuang-chengpu cases (1911) and last Shansi epidemic (1918). The disease attacks particularly poor people because of their surroundings; but doctors, nurses, students, merchants, Europeans, Chinese, Indians, Japanese, etc., have all been attacked and succumbed.

Symptomatology. The incubation period is usually two to three days, but this may extend to five days. The *onset* of the disease is usually abrupt; prodromal symptoms are rare. The disease begins with chilly sensations, but a distinct rigor does not occur. There is headache, loss of appetite, increased pulse rate, and fever. Vomiting rarely occurs.

Progress of the case. From 24 to 36 hours after the onset, the temperature has usually risen to 103-104° F. (39.4-40° C.) and the pulse rate to 110-130 per minute. Cough and dyspnoea appear within 24 hours after the onset of symptoms. The cough is usually easy and not painful. The expectoration is at first scanty, but soon becomes more abundant. The sputum consists at first of mucus which shortly becomes blood-tinged; later it is much thinner, frothy and of a bright red colour; it now contains enormous numbers of plague bacilli in almost pure culture. The typical rusty sputum of croupous pneumonia is not observed. The conjunctivae become injected, and the tongue assumes a brown or brownish-red coat. The headache becomes worse, the expression is anxious, and face frequently takes on a dusky hue. Labial herpes is not seen. The patient complains of pain and a restricted feeling in the chest, but this is not severe. Apart from the disturbance due to the dyspnoea and their anxiety for their condition, the patients appear to suffer little pain. In the later stages of the disease, the respirations become greatly increased and the dyspnoea is very marked, the patients gasping for breath several hours before death. Cyanosis is then common and ecchymotic spots appear in several parts of the skin, the two conditions producing a black hue and thus giving rise to the name 'Black Death.'

The signs of cardiac involvement are very marked in advanced cases, the pulse becoming more rapid, soft, and feeble, until finally it cannot be felt. Death results from cardiac paralysis and exhaustion. The patients sometimes succumb after slight physical exertion, such as sitting up in bed or being moved. The temperature may decline to below normal before death. Delirium or coma is often met with before death. The urine in the later stages may show the presence of albumin. The diazo and indican reactions have not been observed in the few cases examined.

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[1] "Practice of Medicine in the Tropics" published in 1922 by the Oxford University Press. Vol. II pp. 1038-1046

The spleen is usually not palphable, and the lymphatic glands are not enlarged. Bloody diarrhoea is occasionally observed, when B. pestis is found in large numbers in the stools. Leucocytosis is usually not present.

Physical signs. The physical signs in the lungs are often slight, even in cases well advanced in the disease. On percussion, dulness is often absent, and the vocal fremitus and resonance unchanged. In a small proportion of cases, however, localised areas of dulness may be distinguished. On auscultation, râles are frequently not heard except before death. When present early in the disease they are usually of the fine variety. Numerous râles are heard late in the disease, due to the oedematous condition of the lungs. Feeble respiratory sounds or pure tubular respiration over small areas are commonly heard. Not infrequently a dry pleuritic rub is heard at the side of the chest.

The heart is usually dilated on the right side, but not greatly. The heart sounds are fast and become feeble towards the end. In the early stages the second pulmonary sound may be aceentuated, but this character is soon lost.

Complications and Sequelae. Pulmonary plague always ends in death with general signs of septicaemia caused by the B. pestis. The progress is very rapid, death usually taking place in two to three days from the onset of symptoms.

Diagnosis. The diagnosis of pulmonary plague is usually clear from the bacteriological examination of the sputum in which the bacillus is found in enormous numbers and in almost pure culture. A rise in temperature and an increased pulse rate are sometimes the only early symptoms noticed, and before the characteristic sputum appears the diagnosis may be doubtful, especially at the commencement of an epidemic or in isolated cases. However, the blood should always be examined microscopically and culturally, as the case may be one of primary septicaemia. A bacteriological diagnosis is the only certain method for excluding pneumonic infection due to organisms other than B. pestis, though the absence of clear physical signs in the lungs ought to suggest plague infection. As has been said above, coarse sibilant sounds and râles are seldom heard in plague pneumonia.

The sputum in plague is not purulent but of a thin, frothy, pink, or red nature. The cough is generally not so troublesome as in croupous pneumonia. The duration of the disease is usually less than two days, and many cases succmb within 16 hours from the onset of symptoms. Cases may last three, sometimes four days, but rarely more.

Differential Diagnosis. Pulmonary plague has to be differentiated from typhus exanthematicus, ordinary croupous or broncho- pneumonia, relapsing fever, and influenzal pneumonia. The extraordinary virulence of the recent pandemic of influenza (1918), in which such a large proportion of pneumonia complications occurred with symptoms and signs unusually like those of pulmonary plague, has suggested to some observers the possibility of the causative organism being an attenuated form of B. pestis. But whereas in pneumonic plague B. pestis exists always in enormous numbers in the sputum, in influenza pneumonia a large variety of organisms, with or without Pfeiffer's bacillus, are present, but never B. pestis.

Prognosis. The prognosis is wellnigh hopeless, as no authentic case of pulmonary plague in either of the two great epidemics has been known to survive.

Treatment. This is also not satisfactory, and the best that can be done for a patient is to allay his sufferings. As soon as a case is diagnosed, the patient should be forthwith isolated, preferably in a hospital built for the purpose, and the contacts kept under observation. In Manchuria and Shansi, owing to the primitive conditions of living and to the conservative ideas of the inhabitants, it was most difficult to adopt strict quarantine measures. In an epidemic, unless the local police authorities are placed under the control of the trained sanitary officers, leakages in the organisation are bound to occur and the infection spreads unnecessarily. Capitalistic interests, official dignity, and medical efficiency are often at loggerheads on such occasions. The only remedy appears to be education, not only of the poor but also of the educated classes, in matters of quarantine and sanitation. In the Shansi epidemic, Young allowed the contacts to remain isolated in their own compounds, while the plague patient was removed to hospital. Each individual was taught to use a gauze mask, and although in some cases whole families were wiped out one after the other, the people were kept calm and learnt elementary measures of precaution. Any harsher measure would have produced riots. In the Manchurian epidemic 1911, although much opposition was experienced at first, the people followed the advice of the sanitary officers, even to the extent of permitting 6,000 bodies to be cremated in Fuchiatien alone. As a result of the successful measures in this city other cities followed suit, and cremated their own dead even when no medical officer was in charge.

Prophylaxis.

General. Apart from personal care, the strictest attention should be devoted to the adoption of general sanitary measures. On removal of a plague patient, his bedding should be collected and sterilized, preferably by steam or, if this be unavailable, by exposure to sun or steeping in a solution of cresol or izal.

The room and furniture should be disinfected in the usual way. All cups and small articles likely to have been grossly contaminated with sputum should be boiled. In case of death, especially in winter, when the ground may be frozen to a depth of seven feet, the bodies may be confined in coffins and sent to a prepared pit for cremation along with others. This method, wherever available, is the most economical and efficient, and prevents the possibility of the bodies being gnawed by rats and thus leading to a bubonic epidemic. The management of an epidemic of pulmonary plague depends much upon the locality and upon the nature of the inhabitants. Where the people are educated to these necessary measures, as in Suffolk (1918), the outbreak should be at once suppressed, but in distant provinces in China, where the masses are not yet ripe for preventive medicine, considerable opposition may be expected. Wherever possible, the full co-operation of the local authorities should be obtained by the sanitary officers in charge.

Personal. No vaccine or serum discovered has yet been successful in immunizing a person against plague pneumonia. Hence, those in attendance upon the suspected and sick, such as sanitary officers, hospital assistants, stretcher coolies, disinfection staff, are advised to wear a proper mask as recommended by the Mukden Conference. There is no need to apply any deodorant or antiseptic to this mask, as its protective properties are entirely mechanical."

II. NOTE ON THE BEGINNING AND DECLINE OF THE EPIDEMIC.

So far as we can ascertain, pneumonic plague epidemics have arisen as the result of earlier bubonic infections, which develope lung symptoms. These cases cough up masses of plague bacilli in the sputum, and under suitable circumstances such as overcrowding, winter weather, proper humidity, and indiscriminate spitting, infect others by the droplet method. Isolated instances of pneumonic plague arising in a laboratory have been recorded [2,3]. Simpson observed on several occasions "the first in a series of pneumonic cases occurring

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[2] Poech, Ueber die Beulenpest in Bombay im Jahre 1897, Vol. I.

[3] Mededeelingen van de Burg. Geneesk. Dienst in Nederlandsch-Indie 1916/V/I.

in an infected locality, the first generally arising in a house in which a large number of rats have died." Two interesting examples of pneumonic plague occurring on board steamers were found in the case of (1) the British freight steamer *Friary*, which lost 8 lascars out of a crew of 21 in 1901, and (2) British mail steamer *Nagoya*, which had eight deaths out a crew of 195 in 1919. Although no bubonic cases appears to have been observed immediately before the 1910-11 outbreak, it is very probable that it originated in this manner inasmuch as in the years preceding the epidemic sporadic cases of bubonic plague alternated with pneumonic cases in the endemic centres of Transbaikalia and Kirghiz steppes.[4]

From the 1921 epidemic we have been able to establish a complete link in the chain of evidence so far as human cases are concerned. Bubonic infections occurred in Transbaikalia in the late summer of 1920. Besides some cases at Kailastu (70 versts west of Manchouli) four were reported in September from Abagatui (Mongolia, 8 versts from Manchouli) and three from Dauria (60 versts west of Manchouli). Two Cossack soldiers were infected by the Abagatui cases and died, the last on the 20th September. After this no more was heard until October when plague was reported at Hailar. Most of the Hailar cases were observed by us. They are tabulated in Tables I and II, and described under another heading of this article.

After the bubonic cases, a series of the septicemic variety were met, leading later on to the purely pneumonic ones. The slow rate of increase in the number of cases from October to end of November was characteristic, and this differed markedly from the rapid spread in other places as soon as the pneumonic type was fully developed.

What then is the reason for this change in the character of the epidemic? In India, as we all know, occasional instances of pneumonic plague were seen among a large majority of bubonic cases, but these rarely developed into an epidemic. In Siberia, Mongolia, Manchuria and Shansi, on the other hand, the early bubonic cases showed a tendency to assume the pneumonic form, and although extensive outbreaks were comparatively infrequent, (in Manchuria only two epidemics in ten years) the danger of a pneumonic outbreak succeeding the bubonic infections has always to be borne in mind.

Barber and Teague[5] tried by experiments with V. cholera, Sarcina and B. prodigiosus to elucidate this phenomenon.

In their opinion the bacilli of pneumonic plague sputum were enabled to persist longer in an atmosphere with a low water deficit, such as is met with in the crowded inns of Manchuria in the winter. Hence the longer these droplets persisted, the greater would be the danger to the inmates. The Manchurian climate with a temperature considerably below zero C. fulfilled these conditions, and was therefore largely responsible for the propagation of the disease which would not happen in a warm country.

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[4] Wu Lien Teh, I, c. p. 1038.

[5] Phil. Journal of Sc. Vol. VII, Sec. B. No. 3, p. 157.

While ready to admit a cold climate as an important factor in the spread of pneumonic plague, we are not sure that the propagation of the disease is entirely due to this water deficit. It is possible that the origin of the Manchurian attacks can be traced to plague among marmots and not to an epizootic among rats. In this connection, it may be profitable to remember a statement made by McCoy that "Pneumonic plague in man rarely occurs from rat infections and it is an interesting and possibly significant fact that in plague squirrels there is a very definite tendency to pulmonary localisation, a condition which never occurs in plague rats." At the same time, the peculiar way in which the Hailar cases developed in 1920 strongly suggests a rat-flea infection.

Before discussing the decline of the epidemic it is necessary to review the observations made on the virulence of the B. P. in pneumonic plague. At the time of the Mukden Conference, experiments comparing the virulence of bubonic strains with those recently isolated during the pneumonic epidemic were made, and led to the conclusion that the B. P. in pneumonic plague possesses a higher virulence than many of the bubonic strains tested. Strong observed further there was a tendency to marked stability in the virulence of the B. P. Others contended that a longer incubation period was noticed towards the end of the epidemic, but these observations were probably not reliable[7] and experimental evidence showed the virulence at the end of the epidemic to be undiminished.

Thus when the question of a spontaneous decline of the epidemic was raised it was evident that this supposed phenomenon could not be traced to a lessened virulence of the B.P. All observers agreed that, even if there should exist a spontaneous decline of the epidemic, the preventive measures were of the utmost importance in restricting the number of cases during the prevalence of the epidemic. Most of those taking part in this discussion were even of opinion that the preventive measures alone were responsible for the termination and denied the possibility of a spontaneous decline. On the other hand, some stress was laid on the possible influence of metereological

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[6] Am. Journal Hyg., Vol. I, No. 2.

[7] Mukden Report, pp. 73-74.

[8] Mukden Report, pp. 55-75.

factors upon the course of the epidemic. The Conference thus decided: "The chief factor in the decline of the epidemic has probably been the preventive measures which were enforced, either in accordance with scientific methods or by the crude efforts of the people to protect themselves. Climatic influences may have contributed indirectly, or even directly, toward bringing the epidemic to end, but the evidence presented on these points is inconclusive. The decline has not been due to any loss of virulence of the bacillus."

As shown in our paper on the postmortem findings of 1921 we found one factor which might possibly play an important role in the decline of the epidemic. This was the prevalence of pneumonic cases at the height of the epidemic as compared with their scarcity towards the end, at which period only pulmonary cases prevailed. These were far less infectious, because of the absence of sputum, than the strictly pneumonic. Being thus rendered less infectious, the "spontaneous decline" of the epidemic, even in foci unattended by sanitary organisations, might be easily explained.

III. Observations on Infectivity, Epidemiology and Incubation Period.

In these epidemiological and clinical notes only such observations will be mentioned which seemed rare in former outbreaks or not mentioned at all.

Instances were seen where contacts had been certainly exposed to infection and yet remained healthy.[9] Chun ("Salient points about the recent pneumonic plague in Harbin") mentioned the fact that many patients suffering from ordinary diseases were sent to the hospital as plague cases. It was impossible for the inspection squads to be always right in their *prima vista* diagnosis, especially with the Russian squads in the Railway area where they had great difficulty in ascertaining the history of the sick.

So, instead of taking the risk of leaving the possibly plague patients in their homes, they sent many "suspects" to the hospital where special wards were provided for them. On admission every precaution was taken by us to separate the real plague cases from the suspects, while patients who suffered from ordinary diseases were sent home wherever possible.

In spite of the exercise of much care, it happened that patients suffering from ordinary diseases did sometimes stay in the plague wards during the 1921 epidemic, the same as in the 1911 outbreak.[10]

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[9] Mukden Report, p. 389.

[10] Mukden Report, p. 295.

a. A man, aged 26, was admitted into the plague ward, as he expectorated sanguinous sputum, and remained there eight days. During this period, three other plague patients were put in the same ward and died. Further investigation into his case revealed the fact that he was really suffering from croupous pneumonia. Two animals were injected with his sputum and both died, showing only pneumococci in their organs. This patient made a good recovery afterwards.

b. Three Chinese from Irkutsk were admitted into the plague ward. They were refugees and starved. They passed through the plague infected region on their way to Harbin and were thought to be suffering from plague. One of them did die of plague soon after admission, the second man died of inanition, but the third man, named An did not die after spending 11 days in the ward. This man was particularly interesting, because he volunteered to work as ward attendant, and after a few weeks' duty was infected with plague and died. So one could not consider him as naturally immune because he did not at first "catch" plague during his stay as a patient in the ward.

In connection with first case (a) the possibility of the protection afforded by a pneumococcal infection against plague has to be considered.[11] We accidently came across some apparent evidence to support this when injecting rabbits with plague cultures contaminated with Diplococcus lanceolatus. The rabbits died quickly, but at P.M. only pneumococci could be recovered. A very interesting instance was observed in Dalainor. On 6th February, three plague corpses were discovered under a bench in an opium den kept by a Japanese woman. The owner and sixteen men found smoking in the den were all removed to the isolation wagons, but none of them was subsequently attacked with plague.

Dr. Hsieh, in his report on these cases, remarked that the local people believed that opium smokers were immune to plague. Of course, there is no evidence that this belief is justified and so one may put it in the same category as the supposed prophylactic use of alcohol against cholera.

As a spoke in the wheel, we may mention that while conducting P.M. examinations, we noticed many plague corpses with morphine-injection marks.

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[11] Mukden Report, pp. 157-158.

As in the previous epidemic[12] we also observed instances where people attended on their sick relatives and yet did not get infected. A woman, age 24, looked after two plague stricken relatives and when they died, she attended on her father. Because she had fever (afterwards found to be due to an alveolar abscess) she and her father were admitted into the same room in the suspect ward. On the next day, her father died of plague pneumonia. She herself recovered from her abscess three days later and was sent home after a further period of 5 days.

We found that in several instances children escaped infection while the rest of their family succumbed to plague.

1. In Shwang Cheng Pu, 13 members of a family living in a compound died within two weeks, leaving a child one year old.
2. In Harbin, a boy of 11 remained well while six members of the same household died within two days.

3, 4. In the hospital we had two lots of children who did not get plague, though their mothers succumbed.

We can only cite these cases[13] as curious and lucky escapes and cannot deduce therefrom evidence of immunity of children from plague.

Out of 3412 prostitutes in Fuchiatien, only 12 deaths from plague were reported. Twelve servants (men) also died. The brothels were closed for one month at the beginning of the epidemic but were reopened later on and some deaths among the guests were reported.

The theatres were also closed at the beginning, but some of them were reopened. Several cases of plague occurred among the stage people living on the premises.

Four instances were on record where a plague patient suffering from fever and cough was travelling in a crowded railway car on the Harbin-Changchun line (150 miles). On 2nd February, a dying man with haemoptysis was found on the train at Yaomen. The other 47 passengers were sent on to Harbin for observation, but as they remained healthy after six days, were liberated. On 16th, 20th Feb. and 15th March, 37, 47 and 30 passengers respectively travelled on each occasion with a sick man but no one developed plague subsequently. Jasienski reported a similar instance in the previous epidemic.[14]

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[12] Mukden Report, p. 232.

[13] Mukden Report, p. 172.

[14] Mukden Report, p. 220.

In contrast to the above, we may cite a few interesting cases of infection by contact.

1. A prisoner (convicted for theft) was ill with plague after 2 days' confinement and was sent to the hospital where he died. Three days later 5 other prisoners from the same cell died of plague.

2. In an iron foundry, a man died of plague. To avoid inconvenience, the owner induced a military sergeant to rush the body to the burial ground without notifying the police. Soon after 2 persons including the owner died, one after the other. Three remaining contacts (including brother of owner) were sent to the isolation wagons.

3. In a Cold Storage Company, a fitter visited his father who was ill with plague in the city. After his father's death, he got four friends who were living with the other labourers of the company to carry the corpse and deposit it on the street. The next day he was ill with plague and on the day after that his four friends were also plague stricken. They all died in the hospital 48 hours after admission. Meanwhile, other cases occurred in the labourers' quarters and the contacts ran away to different places. One of the fugitives infected a household of 12 persons.

Sanitary Squads and Burial-Ground Personnel.

All available data from Harbin and Dalainor were tabulated in Tables III and IV.

Mortality among the Sanitary squads was high, especially in Dalainor where it reached 50%, the highest figure reported in the previous epidemic. [15]

When comparing this high mortality among the sanitary coolies with the clear record of our dressers, one must bear in mind the fact that the coolies were certainly more exposed to infection than the dressers. Moreover, the dressers were more aware of the danger and took care to follow the precautionary measures exactly.

To account for the high percentage of infection among the sanitary coolies and sanitary police, one more factor has to be considered, namely, the stealing of money and clothes belonging to the corpses. Thus two of the coolies and one policeman were known to have committed thefts of this nature in the plague wards at night-time. As they died soon afterwards of plague, we may say that some indirect evidence of the infectivity of the clothes and money is established.

This factor also deserves notice when we consider the high mortality of the burial-ground coolies in Harbin. In Dalainor, however, Dr. Hsieh did not find any plague deaths among the burial-ground coolies, although they undoubtedly committed thefts.

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[15] Mukden Report, p. 194.

INCUBATION PERIOD.

The average incubation period was three days, varying from 2-6 days. Longer periods were also observed as in the previous epidemic. Thus :—

1. One man was sent from the Isolation wagons to the suspect ward because he had fever. He had continuous fever for 7 days, but repeated examinations of his non-sanguinous sputum proved negative, until the 7th day when he showed B. P. and blood in his sputum.
2. A case was reported from Asheho of a man dying 8 days after the death of his wife.
3. A woman, aged 17, was sent to the Isolation wagon after the death of her husband. For 6 days she had a normal temperature. Before going home, she had a bath. She then felt ill and giddy but was able to walk home, a distance of half mile. Soon after she became very ill and was admitted into our hospital after six hours. On admission she had no cough or expectoration. But on the next morning plenty of blood and B. P. were found in her sputum and death occurred 24 hours later. P.M. examination (No. 6) revealed plague pneumonia.

IV. NOTES ON SYMPTOMATOLOGY AND THERAPY.

a. Non-infective period at beginning of disease.

We can say without hesitation that as a rule there is a non-infective period of about 24 hours during which the patient has fever and quick pulse but no cough or bloody expectoration. This is the time when he may be moved to hospital without danger to others.

As an illustration, Dr. Yuan Teh Mao, chief of the inspection squad, felt a little unwell on the morning of the 5th day after infection. He was on duty nevertheless, attended a meeting of 26 people in the afternoon and mixed with the other members of the staff for the whole day. In the evening, he went to bed with fever 102° F. Next morning, he had a little cough and B. P. and blood were found in his sputum. None of the 60 persons he came in contact with the previous day were infected.

Chung[16] reported a similar instance (case of a Japanese doctor).

Zabolotny[17] remarked on this non-infective period which he estimated at two days.

b. Observations upon cough and haemoptysis.

The cough of the plague patient is at first dry, but very soon he expectorates a liquid, frothy and bright red sputum. Frequently, there is a considerable amount of bloody sputum, especially among young patients, so that the floor and bedding are covered with blood. For instance, a patient was able to spit into 12 Petri dishes within a few minutes and was still coughing and spitting afterwards. Sometimes profuse haemorrhage was observed immediately before death.

Epistaxis was not observed. Bloody froth was often seen at the nostrils of patients *in extremis* and corpses.

Cases with no cough or sputum will be mentioned later on.

c. Pain.

There is not much pain in connection with plague pneumonia, in contrast to ordinary pleuro-pneumonia, though a few exceptions were observed. Nearing death, the patient is very short of breath, mildly delirious, often tries to sit up or struggles to go out into the open air. He is not conscious of much pain owing to CO_2 intoxication and incipient oedema of the brain. Some cases in Manchouli were reported to keep cheerful in spite of alarmingly profuse haemorrhagic expectoration.

Active delirium is rare. This may be due to the gentle and stoical nature of the patients who are mostly coolies and are not addicted to alcohol.

d. Symptoms of in-coordination.

The loss of co-ordination of the voluntary muscles of the legs together with other nervous symptoms render the plague patient unsteady in his gait. To the uninitiated, he resembles a drunken man and several drunkards have been sent into the hospital as possible plague cases.

This staggering gait has not been explained on anatomical grounds. Simpson[18] ascribed this symptom "to a progressively intoxicating effect of the plague virus on the nervous system." Our records mention the following:—

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[16] Mukden Report, p. 226.

[17] Mukden Report, p. 91.

[18] Simpson p. 267.

1. A man, aged 24, on admission into the hospital, stumbled on to a long wooden stool and fell head first, almost turning a somersault. After lying on the ground for five minutes he got up with great effort and sat on the stool, still unable to hold his head up. He rested on another patient lying on the stool next to him.

   He could not answer questions. His knee-jerks were not exaggerated and as far as one could judge, he had no nystagmus. He died half an hour afterwards with increasing dyspnoea and cyanosis. At P.M. (No. 16) the meninges were found to be congested while the brain was oedematous. The petrous portion of the temporal bone was removed for further examination.

2. Another man was closely observed. He could walk, though unsteadily, to the ward. After five minutes, he wished to come out, but was now able to walk only with assistance. He evidently felt giddy for he held on to the drain-pipe for three minutes. Then he fell down gasping and died after 8 minutes.

e. Clinical observations upon urine and faeces.

Only little attention was directed towards the urine and faeces of plague patients in the previous epidemic. Kasai examined six samples of urine. He found them clear or slightly cloudy, acid in reaction, and with a specific gravity of 1024-34. Albumen was found in 2 out of the 6. Diazo reaction, indican, sugar and blood tests were negative.

A systematic analysis of 30 urines was conducted by Chun. in 1921, who noticed that the chlorides were diminished in all cases, a feature usually found in ordinary pneumonia and bubonic plague [19] [20] and other fevers. The absence of blood is noteworthy. Other findings corresponded with those changes met with in acute febrile diseases. No case of *intestinal infection* during life was observed, in contrast to clinical reports of cases during the previous epidemic.[21] At the P.M. (No. 12) of a young subject (age 10) liquid stool was seen flowing out of the rectum. The mesenteric glands were enlarged as usual. Nothing abnormal was detected in the alimentary canal. Cultures of B. P. were obtained from the ileum and colon as in other cases.

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[19] Simpson p. 292.

[20] Jennings, Manual of Plague, p. 89.

[21] Mukden Report, pp. 165-183.

f. Duration of disease.

Tabulation showing duration of stay of plague patients in hospital:—

	No. of Patients Recorded	Average Stay in Days	Longest Stay	Average Duration
February ...	85	2.8		
March	476	1.7	9 days	1.8 days
April	561	1.7		
May	6	2.1		

In the majority of cases, patients were sent into the hospital within a few hours of their illness. So the above average duration 1. 8 days, may well be taken as the duration of the illness, and corresponds with those findings of Kasai [22] and Strong. [23] It is 24 hours longer than what Haffkine [24] found in Harbin Jan. 1911, however. Emphasis must be laid on the fact that the average duration of illness towards the end of the epidemic (April and May) was no longer than at the beginning —another proof that the virulence of B. P. was in no wise diminished.

Kasai (l.c.) recorded a few instances where the patients survived 5—7 days. We were able to observe a case of nine days (see Table V). A man, aged 32, (P. M. No. 11) came to the hospital voluntarily on the 16th March. After admission, he had fever continuously, 102° F., feeble pulse and B. P. and blood in his sputum. Beside the abnormal length of illness, his sputum assumed a muco-purulent and rusty red appearance during the later stages, though plenty B. P. were present. On the 23rd March a flask of B. subtilis emulsion was injected subcutaneously with some apparent benefit. On the morning of the 24th, he was semi-conscious though he could be aroused. Towards noon, he became stertorous and died half an hour later of heart failure.

At P.M., broncho-pneumonia was found in four lobes; no other unusual features, except an anaemic infarct in spleen which is the only one found in our P. M. examinations.

g. Cases among children.

A few cases of plague among children and women came under our notice. Economic conditions force the coolies to migrate from Shantung and Chihli to Manchuria leaving their womenfolk and children behind, and to live in crowded lodgings. These factors account for the high percentage of coolies among our patients and the small percentage of women and children.

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[22] Mukden Report, p 177-178.
[23] Mukden Report, p. 431.
[24] Mukden Report, p. 106.

Both clinical and P. M. observations show that the children succumbed to plague more easily and quickly than adults. For, out of six P.M. examinations of children, only two had well marked pneumonic changes. One pulmonary case was seen at the height of the epidemic, two had slight pneumonic changes, and one had a single patch of pneumonia. The case of a still-born foetus is fully described in the P.M. article.

h. Non-pneumonic cases in 1921 epidemic.

i. Bubonic. We have seen the series of bubonic cases beginning with those at Abagatui (August), Kailastu and Dauria (September). One of the Abagatui cases was treated at Manchouli Hospital and recovered. Two Cossacks infected by this family developed buboes and died (the last on September 20th). Out of the possible thirteen, only one recovered.

Then came the Hailar cases, numbering at least eleven, the earliest ones, as in the previous thirteen, being entirely among Russians.

Throughout the epidemic, which now assumed a pneumonic character, we were on the lookout for further bubonic cases, but the following were the only ones recorded in this series: —

I—One doubtful bubo in a Russian man from the Priamur dustrict treated at Suifenho. This patient died on 9th March.

II—One bubonic case reported in February by a Russian lady physician of Chita as occurring among 22 cases at six cities in Transbaikalia.

III—One bubo in right groin of a Russian woman Bulak, aged 25, pregnant four months. We saw this patient on April 5th and following days. Patient was married and lived in a small house in Pristan doing her own household work. In the same compound some Chinese were living, but no plague cases hand so far been reported there. On March 31st she experienced a prick in right foot and noticed a small swelling in the groin next morning (Ap. 1st) with fever. When admitted on April 4th, both right femoral and right inguinal regions were swollen, each of size of walnut. Dr. Askanoff of the Railway Hospital punctured the femoral bubo and noticed a few definite B. pestis in the smears (15 B. P. on one slide). Cultivations and animal experiments with gps. gave positive results for B. P. Bubonic plague was therefore diagnosed. On the day of our examination (Ap. 5th), there was considerable swelling, the inguinal bubo measuring size of a small apple, and the femoral slightly smaller. Both swellings were painful and tender. Ichthyol was applied to the region. 240 c.c. anti-pest serum (Japan) was injected on April 4th, and repeated next day. There was marked induration at site. Patient looked flushed but not very ill. Temperature undulat- appeared with fall of temperature and patient eventually ed about 39.5 for some days. The swelling gradually dis- recovered. A full grown baby was born at proper time well.

IV—Russian man was admitted into Manchouli Hospital on May 26th with a marked right submaxillary bubo. He had no cough or sputum. He looked very ill and had high temperature. He died on May 29th after 4 days' illness.

V—Out of 469 cases of plague at Vladivostok all were pneumonic except one Russian with a right inguinal bubo, who was admitted on July 10th and died two days later. About this time systematic rat examinations showed two positive infections on July 2nd, and again five between July 18-23.

VI—Murakami (Japanese Military surgeon) also reported a doubtful bubonic case in Vladivostok on August 10th.

Of those six cases—all in Russians, two were doubtful, two were in right limb, oe was in submaxillary region, while the location of the sixth (Transbaikal) one was not stated. The only case we have full data of was that of the Russian woman, who was seen in hospital 4 days after the alleged prick. If the swelling was due to this prick as she believed, it must have developed unusually quickly for an ordinary septic infection. But a scratch due to fleas might easily have been mistaken for a prick. It is likely that the mode of entry of the B. P. in her case was not dissimilar to that of any other bubonic case, namely through a rat flea. The fact that no other case of plague-either pneumonic or bubonic-occurred in the same compound tended to support this theory of a stray infection.

Should any accidental sputum touch the abrased skin of a hand, the bubo would then appear in the axilla, which none of our cases showed. Still the mystery remains as to the appearance of the rare instances of bubonic plague among thousands of pneumonic cases seen. We have no explanation to offer as to their actual cause. It is noteworthy that no cases of bubonic plague developed towards the end of 1921 epidemic as in the case of Kashmir.

ii. Pulmonary cases. In two separate articles we have drawn attention to the occurrence of strictly pulmonary cases towards the end of epidemic. Cases apparently similar to these pulmonary ones were met wtih at postmortems *during* (not end of) the epidemic of 1910-11. Similar clinical observations were made at that time. Christie maintained that "septicemic" cases were comparatively frequent and formed about 10% of all cases; however, owing to the rapid death in this type of the disease very few patients died in the hospitals. Hill after examining the rough clinical records of 15,000 cases in 1911 said "the septicaemic cases without pneumonia constituted a very small proportion of the whole, probably about 1% or less."

Our own observations tended to confirm this rare occurrence of the pulmonary type at the height of the epidemic. It is true that at this time our autopsies were mostly performed on cases which had been observed clinically and not on cadavers picked up in the streets, but there is no evidence to prove that the street corpses had succumbed to the type described by Christie. According to our observations most of these cases had been sick and died inside the houses and were then thrown out in order to avoid isolation of the rest of the household. It is interesting to recall P.M. 17 (child of one year) found dead in the street at beginning of April, and showing not the pulmonary but only slight pneumonic changes. Should any further occasion arise, it might be wise for investigations to be directed upon these street corpses during the height of the epidemic.

In our records we found seven instances where patients died suddenly without apparent signs of pneumonia. One of these may be mentioned here. A girl aet. 3 (No. 4 of our P.M. series) was admitted as contact on March 4th because her mother suffered from plague. Swab taken from the throat of the child showed pneumococci in smears and thin gramnegative bacilli; in cultures, micrococcus catarrhalis and a few bipolar-stained gramnegative suspicious bacteria. The child was placed on March 4th. under the care of an elderly woman, who however took ill on March 5th. and died the same evening. The child was then placed under the care of two men convalescent from typhoid. She looked well and bright the whole day of March 5th and had no cough or bloody expectoration. She died early on March 6th. At P.M. slight reaction in larynx and trachea and slight pneumonic changes in lungs were found (Group B. of our cases). Thus this case cannot be considered as pulmonary in the strictest sense of the word, but belongs to the same category as Case 17 mentioned above. Similar cases were met with in our experience where patients died suddenly from apparent pneumonia and did not show cough with bloody expectoration until immediately before death.

i. Therapeutic measures.

No form of treatment was found of any avail. However, mention should be made of several attempts to save the lives of our plague patients. No effort was spared in trying to help Dr. Yuan, our able colleague, and others of our staff who were infected in the course of their duty.

The thereapeutic agents used were:—

1. Antiplague serum (Japanese source) 40-80 c.c. (repeated several times), both intravenously and hypodermically.
2. Methylene blue *per os.*
3. Eusol 20-120 c.c. intravenously.
4. Formalin solution (I-200 strength) 100-200 c.c. intravenously.
5. Neoarsenobenzol 0.4-0.9 grm intravenously.
6. Sod. gynocardate 2 c.c. of 1% solution intravenously.
7. B. Subtilis emulsion 25 c.c.
8. B. H. emulsion 25 c.c.
9. Electrargol 10 c.c. hypodermically.

Some of the drugs were repeated on the same day, and were given as soon as the diagnosis was reasonably sure. As reported, they did not cure the patient, nor did they prolong life. On the other hand, such drugs like neoarsenobenzol, eusol and sod. gynocardate appeared to hasten death, as the patients generally died within 24 hours.

TABLE I.

Bubonic Plague cases, observed at the beginning of the epidemic in Hailar.

No. Case	Residence	Date taken sick	Date admitted to hospital	Date death	Observations
1 Mrs. Tarelkin (Russian)	Ry.bridge barrack	2-. Oct.	....	23. Oct.	Fever, Angina, swollen neck, rigor.
2 Son of Mrs. T. (Russ. aet. 9)	— „ —	Do.	....	Do.	Fever, swollen neck. (Was seen by Russ. hospital Felcher).
3 Soldier Chen (Chinese aet 24)	— , —	23. Oct.	....	25. Oct.	Fever swollen neck, rash on body.
4 Son of Mrs. T. (Russ. aet. 16)	— „ —	15. Nov.	15. Nov.	17. Nov.	T40, rash on body, small, ill defined buboes. Autopsy.
5 Son of Mrs. T. (Russ. aet. 18)	— „ —	Do.	Do.	21. Nov.	T38, bubo left groin Autopsy.
6 Soldier Chang (Chinese aet. 19)	— „ —	17. Nov.	....	19. Nov.	Bubo left armpit
7 Mr. Tarelkin (Russ aet. 43)	— „ —	18. Nov.	18. Nov.	....	Bubo left groin recovery (See Tbl. 2)
8 Soldier Chao (Chinese aet 21)	— „ —	21. Nov.	21. Nov	25. Nov.	Fever, bubo left axilla.
9 Chinese coolie Li	Yi Shun Tien	?	?	13. Nov.	Spleen Punct. Septic. (? Bubo)
10 Wang	Yu Tai Chan	?	?	2. Dec.	Septic. (? Bubo)
11 Han	Soldier's inn	?	?	8 Dec.	Septic. (? Bubo)

TABLE II.

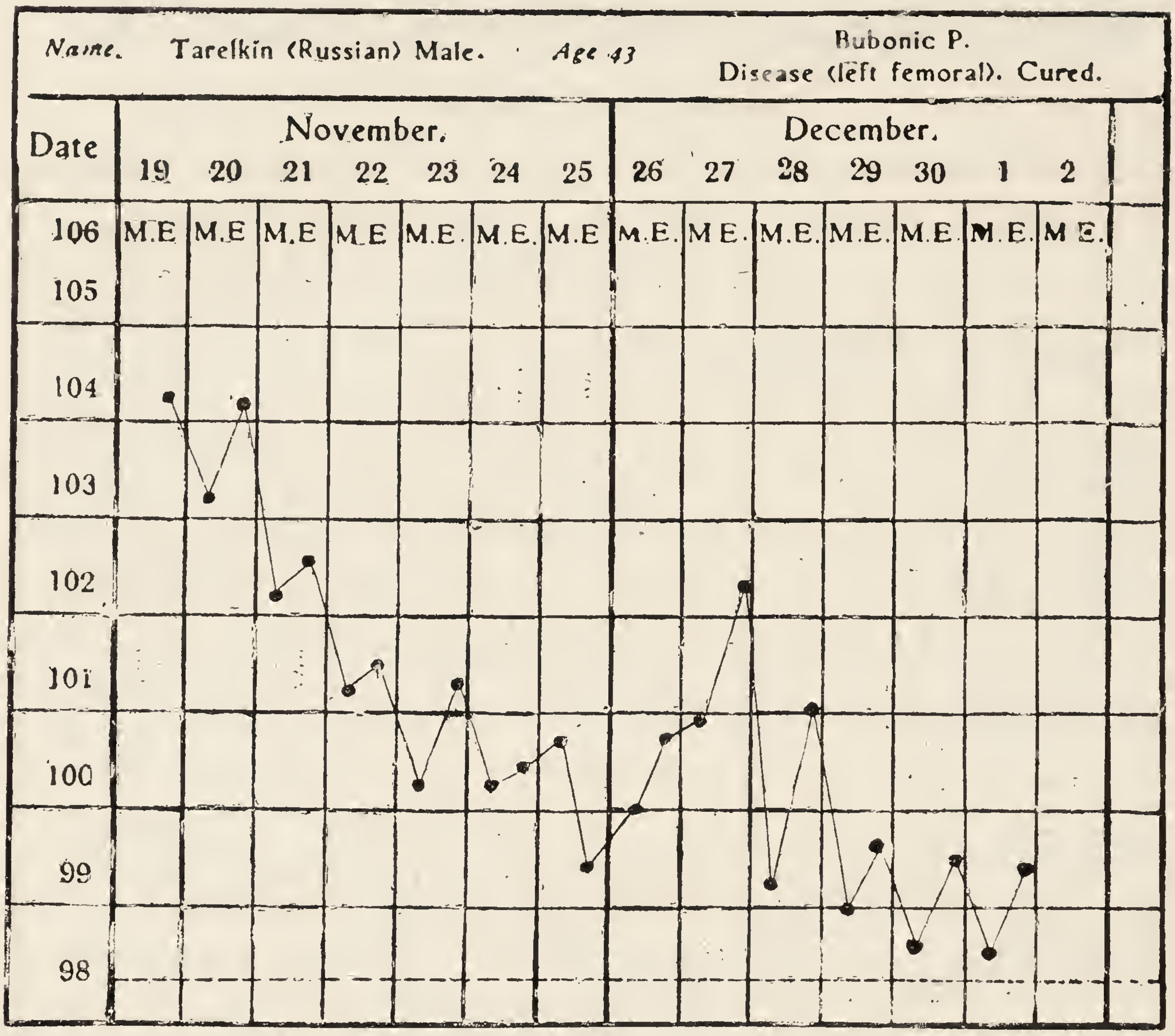


TABLE III.

Tabulation of Sanitary personnel Harbin Hospital.

Character.	*No. employed.*	*No. infected.*	*% infected.*
Doctors	8	1	12,5
Dressers	20	0	0,0
Sanitary coolies	13	5	38,4
Sanitary police	10	1	10,0
Others (cook, etc.) ..	3	0	0,0
Burial coolies	18	7	38,8

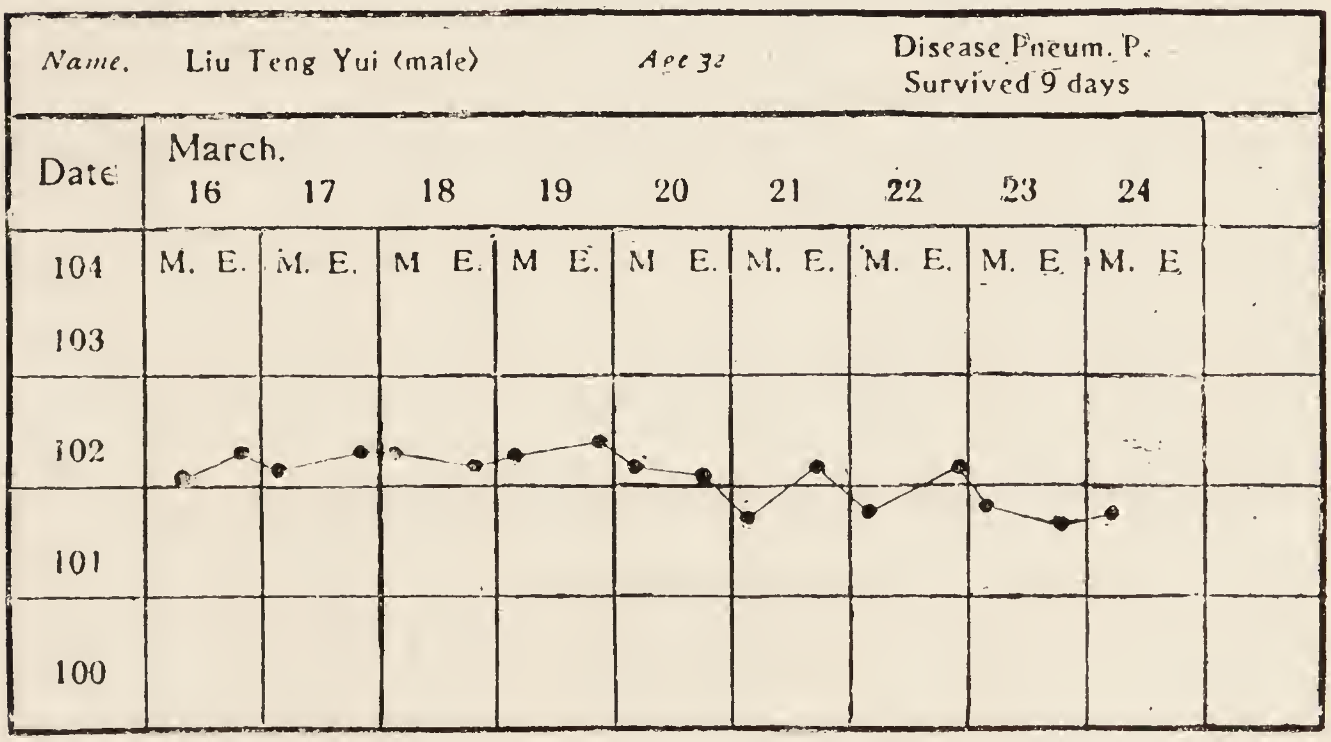
TABLE IV.

Tabulation of our Sanitary personnel in Dalainor.

Character.	*No. employed.*	*No. infected.*	*% infected.*
Doctors	3	0	0,0
Dressers	5	0	0,0
Sanitary coolies	10	5	50,0
Sanitary police ..	40	3	7,50

Note :—The original sanitary personnel in Dalainor were vaccinated with plague vaccine, including 6 of the 10 coolies (four of those vaccinated died) and all the policemen.

TABLE V.



Wu Lien Teh,
J. W. H. Chun,
R. Pollitzer.

PATHOLOGICAL FINDINGS IN PLAGUE PNEUMONIA, SECOND MANCHURIAN EPIDEMIC, 1920-21.

(From the Laboratory of the Manchurian Plague Prevention Service, Harbin.)

By

Wu Lien Teh (G. L. Tuck), M.A., M.D., LL.D., LITT. D., SC.D., J. W. H. Chun, M.B., B.C., M.R.C.S., L.R.C.P., and Robert Pollitzer, M.D., (Vienna).

CONTENTS.

I. Introduction.
  a. General.
  b. Technique Employed.

II. Classification of Cases (acc. to lung findings).
  Group A. Cases with marked Pneumonia and Pleuritis (19).
  Group B. Cases with slight lung and pleural changes (5).
  Group C. Cases without Pneumonia or pleural changes (9).

III. Observations.

IV. Finding in other Organs.

V. Special Case of Mother and Stillborn.

I. Introduction.

i. General.

In reporting on the macroscopic findings of the *postmortem* examinations performed during the second Manchurian Plague Epidemic of 1920-21, we do not deem it necessary to begin with an extensive review of former publications dealing with Pneumonic Plague, as such has already been done by Strong, Crowell and Teague,[1] as well as by Dr. Wu Lien-teh and Woodhead[2] in an exhaustive manner. It seems advisable, however, to cite some of the findings observed during previous epidemics in order if possible to clear up questions which are at present unsettled and to emphasise any similarities or discrepancies seen by us on this occasion as compared with observations made previously by others. These points will be mentioned under their several headings. In this article, only the gross pathological findings will be described, while the histological features will be reserved for a future contribution.

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[1] Philippine Jl. of Science, Vol. Sec. B. No. 3, 1912.

Although both Childe (1897-98)[3] and Albrecht and Ghon (1897)[4] have carefully described the postmortem appearances as found by them in twelve and three cases respectively of Pneumonic Plague, these must be regarded as isolated instances in the chain of Bubonic epidemics generally encountered in India. It was not until the great Manchurian outbreak of 1910-11 occurred that these purely pneumonic cases could be studied wholesale. During this period, Strong and Teague[5] performed 25 autopsies at Mukden, Fujinami[6] made 29 sections (including three on animals) at Mukden, while Koulecha[7] described the results of 28 necropsies as made at Harbin. A quiet interval of ten years then supervened in Manchuria, after which the second epidemic occurred beginning in October 1920 at Hailar and ending in May 1921 at Harbin, although further east, such as Vladivostock, (488 miles east of Harbin) the final case was reported as late as the end of October 1921. Together with two Russian colleagues our Chinese Medical Officers made sixteen autopsies at Hailar (467 miles west of Harbin) during the earlier part of this epidemic, while Dr. Hsieh of our Service made three postmortems on plague cases at Dalainor (566 miles west of Harbin) but no complete records were kept of these cases, and most of the specimens were damaged or spoilt during transit. At Harbin, thanks to the superior facilities offered by our main laboratory, we were able to perform forty-three complete autopsies, of which thirty-four proved to be true pneumonic cases. The principal viscera of this latter series have been preserved in Kaiserling solution for further observation, whenever needed. The other nine non-plague bodies belonged either to cases admitted into our infectious wards during the epidemic or to cadavers picked up in the streets under circumstances suspicious of plague. The whole respiratory organs from the tongue downwards together with oesophagus and heart were removed *en masse*. Careful notes were made by two of us immediately after each postmortem, and these were checked on a second and on a third occasion with the Kaiserling specimens, additions or corrections being made wherever necessary.

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[2] British Jl. of Pathology and Bact. 1912.

[3] British Med. Jl. London, 1897, I, 1215 : 1898, II, 858

[4] Ueber die Beulenpest in Bombay im Jahre 1897, Wien, 1900.

[5] Philippine Jl. of Science, Manila, Vol. Sec. B. No. 3, 1912.

[6] Report of International Plague Conference, Mukden, 1911 P. 144.

[7] Report of International Plague Conference, Mukden, 1911 P. 151.

With the exception of the ones picked up from the streets in May, practically all the bodies upon which *postmortems* were made were fresh, having been chosen from cases which had died a few hours previously. Even in the case of those where twelve or more hours had intervened, no signs of decomposition were noticed, as the months of February and March were cold, the temperature being seldom above $0.^0$ C. The hospital crematorium was situated about fifty yards from the *postmortem* room, both lying in the same compound, so that no undue effort was required to transport a body after section from the *postmortem* room to the cremating pit. All dead bodies from the plague wards were cremated in the hospital crematorium.

ii. TECHNIQUE EMPLOYED.

It may be interesting to mention some points in connection with our *postmortem* technique when dealing with plague cases in the midst of winter. The body to be examined was brought on a wooden stretcher by two attendants. Only four persons were present in the room—three doctors and an assistant. In addition to our usual two-tailed cotton and gauze respiratory mask, goggles were worn, but these often proved inconvenient owing to the condensation of water upon the glasses when coming in from the cold air, and were sometimes discarded. Long india-rubber boots were worn besides the usual overalls. Every one was provided with a pair of medium weight rubber gloves except the actual operator who had an extra pair of long thick ones over the inside pair. In his case, the cuffs of the gown were tied round the wrists after the first pair had been put on; the long pair was next adjusted and tied on the fore-arm. The fingers and wrists thus had a double protection. To further minimise the possibility of accidents, only one doctor performed the actual section and removed the organs, while the others assisted with the trays, pails, liquids, smears and cultivations. After the section was finished, the body was wrapped up in a large piece of cloth which had been soaked in strong cresol solution, and tied at the neck, around the chest and extended arms, and hips. It was then placed on the stretcher and taken to the cremation pit by the attendants. All the instruments, gloves and trays were placed in a large pail and boiled by the P. M. room assistant.

II. CLASSIFICATION OF CASES.

Of the 34 plague cases examined at Harbin, there were 19 with marked pneumonia and pleuritis; five cases showed only slight pneumonia and no pleuritis, thus forming a transition to a third group of nine cases in whic hno pneumonia could be found. The one remaining was a unique autopsy, being that of a full time stillborn foetus of a plague infected mother. This last will be described in a separate chapter. Summarised, these 34 cases run as follows:—

A.	Extensive pneumonia and pleuritis present	19
B.	Slight pneumonia and no pleuritis present	5
C.	No pneumonia and no pleuritis present	9
D.	Special case of stillborn	1
	Total	34

GROUP A. CASES WITH MARKED PNEUMONIA AND PLEURITIS (19).

Of these nineteen, ten were of male adults, six of female adults, and three of male children.

Tongue, Fauces and Pharynx.

Our results in the main are in accord with those noted in the 1910-11 epidemic, the tongue being swollen, brown at the anterior portion, often dark-red and sometimes haemorrhagic at the base, while the pharyngeal wall was congested. In a few cases, only slight hyperaemia and swelling of the papillae of the base of the tongue were noticed. The tonsils were swollen in thirteen of our 34 cases, including P.M. 36 which was complicated by an old abscess. Some congestion was generally seen on the surface and on section. In a few we were able to squeeze out drops of purulent matter on cutting the substance, but until the histological examination proved positive, this could not be regarded as pathognomic of plague. This point will be referred to again in Group C. of our cases.

Larynx, Trachea and Bronchi.

As a rule, the whole respiratory tract from the fauces and larynx downwards assumed a progressively red colour, in some cases not so marked as in others. The blood vessels were injected. On many occasions the epiglottis was intensely swollen and purple in colour. The larynx and vocal cords were generally red and swollen. The trachea was usually covered with pink blood-stained mucus or froth, and its walls were injected, small haemorrhagic points being now and then found in the mucous membrane. This inflammatory change was generally most marked at the bifurcation. We have five cases on record, however, where the larynx and trachea were but slightly congested, so that the mucosa showed only a pink colour. In a sixth case, the trachea presented but a slight reaction, and bloody froth was seen only at the bifurcation. In two instances, simple whitish froth was encountered mixed in places with greenish matter. In one case there were haemorrhages not only in the trachea but also beneath the mucosa of the larynx. In two more, haemorrhages were present in both epiglottis and larynx. One of the latter showed some small patches of necrosis in the mucosa of the trachea. The bronchi, large and small, were markedly congested along the whole mucosa. So far as we could see in no case did this congestion appear to become less marked as the smaller tubes were reached. The deep red longitudinal stripes in the bronchi near the bifurcation as described by Strong[8] could be seen quite frequently.

Pleura.

In our series, we rarely noted ecchymoses beneath the parietal pleura, which were seen often, especially by Strong, in the first Manchurian outbreak, but if seen they were most often situated on the diaphragm. In one instance, we saw an unusually intense congestion of the parietal pleura.

Fluid in the pleura was met with in four of these pneumonic cases, in one case it was blood-stained, in the others greyish-white. It must be stated that while doing spleen punctures for diagnostic purposes, we found not infrequently the spleen dislocated by an exudate situated apparently in the left pleura.

In comparatively few necropsies did we find any fibrin threads or membranes on the surface of the lungs, although these appeared rather common in former epidemics.

In one case we found an inflamed area covered with a fibrinopurulent layer, in three cases with a purulent layer. Microscopic preparations of this purulent matter showed numerous plague bacilli in the leucocytes as well as outside.

Lungs.

All cases in this group had at least one pneumonic area showing the characteristic acute inflammatory changes in the pleura and adjacent lung substance which form such a prominent feature in pneumonic cases. The changes met with most frequently were thickening of the visceral pleura over the whole or part of the surface of a pneumonic area, the pleura being yellowish, with more or less confluent haemorrhages underneath. As stated before, we did not find this charactistic change on every pneumonic area involving the surface of the lung. In a few instances only moderate changes were seen. Among these could be noted some haemorrhages over the slightly bulging pneumonic areas, with no pleural changes and no haemorrhages elsewhere on the pleura. Again, while at times haemorrhages could be detected beneath the whole pleura, on the other hand in two cases we noted haemorrhages over circumscribed areas which were not involved by pneumonia. In others the pleura over a pneumonic area was cloudy, sometimes slightly injected, sometimes showing more or less confluent haemorrhages underneath, but it was seldom thickened. In some pneumonic patches we observed beneath the markedly changed pleura the "yellow and red dots and spots" as described by Albrecht and Ghon.

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[8] Philippine Jl. of Science, Vol. VII, Sec. B. No. 3, P. 215.

At this stage it may be advisable to refer to former descriptions of the lung changes observed in plague pneumonia, as the different authors did not seem to agree, thus making it different to obtain a standard for purposes of comparison.

Whereas some of the earlier workers like Wyssokowitz and Zabolotny,[9] Albrecht and Ghon, and Childe agreed that the pneumonic areas or patches found in their cases were of the lobular or catarrhal type with a tendency to become confluent, Strong and Fujinami stated that the pneumonic areas met with in their *postmortems* were frequently of the lobar type. The report of the Anglo-Indian Plague Commission (1900, 1901) also arrived at the same conclusion. For instance, Strong stated that "although it has been proved that the pneumonia is primarily bronchial in origin or of the lobular type, nevertheless very early lobar involvement was very much more frequently encountered...". In describing his findings in detail, Strong emphasized that he never observed grey hepatisation of a whole lobe, also only rarely large areas of red hepatisation, but that he had cases in which he saw in the same lobe both red and grey hepatisation, whereas another part of the same lobe showed only engorgement. He found both types not only in the same cases but also apparently in the same lobes. On the other hand, in his concluding remarks, he said : "the bacilli rapidly multiply and produce at first pneumonic changes of the lobular type and shortly afterwards from the fusion of several rapidly spreading areas more general lobar involvement of the lung tissue."

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[9] Ann. de l'Inst. Pasteur, Paris, 1897, T. xi. 663.

From this we may gather that Strong distinguished between the "lobular" and "lobar" form of plague pneumonia only so far as the extension of the pathological processes is concerned, but that he considered the latter form as a result of a bronchopneumonia which had become confluent.

Be that as it may, we ourselves find it impossible for the time being to classify all of our cases into the lobular or lobar type of pneumonia, Whereas a considerable number of the changes observed must be classified under the first group, a small number have a lobar appearance while there are quite a number of intermediate forms in which it would be difficult to decide one way or the other. We hope that after a thorough histological examination it will be possible to make more definite statements and to clear up not only the nature of our cases but to a certain degree this whole problem of plague pneumonia.

Before entering into a detailed description, we might state that, as noted by former observers, all the cases of this group presented marked congestion and oedema of the lungs. Should any superficial pneumonic focus exist, a corresponding bulging of that area of the lung surface would be seen. As for the seat of hepatisation, it can be seen from Table I that out of 19 cases, 6 showed involvement of one lobe only (one right lobe in two cases and one left lobe in the other four), 3 showed involvement of two lobes (right lobes twice and right and left lobes once), 2 showed involvement of three lobes (all the three right lobes once), 5 showed involvement of four lobes, and the remaining 3 showed involvement of five lobes. So that in five of our cases the right side alone presented pneumonia and in four the left side alone.

As to the distribution in the different lobes, the right upper lobe was involved 13 times, the right middle lobe 7 times, the right lower lobe 12 times, the left upper lobe 10 times, and the left lower lobe 11 times.

According to our observations the right middle lobe was more often involved than in Fujinami's list, but in general the distribution in our cases agreed with his findings. When there was only one pneumonic area present, it was never found in the right middle or in the right lower lobe. It was situated twice in the right upper lobe, once in the left upper lobe and 3 times in the left lower lobe.

The frequency and distribution of the different forms of pneumonia about to be described can be seen in Table 1.

The most frequent pneumonic change noted was that of a confluent lobular pneumonia. Often there were lobular foci in the stage of red hepatisation which became confluent to form small but in some instances large pneumonic areas. But in the latter case, the whole appearance of the area with islands of non-hepatised lung tissue was sufficient to confirm the diagnosis.

In a few instances, especially when a large portion of a lobe was affected, the colour of the pneumonic areas was reddish-grey or purely grey in part. In one case, almost the whole affected tissue had a reddish-grey colour. This case (P. M. 23) is also remarkable because it can be clearly seen how the different confluent areas are arranged round the ramifications of a small bronchus, thus forming a picture similar to, though of a more advanced type than, that described by Strong. It is hardly necessary to state that in using the term "lobular confluent pneumonia" we do not mean that the changes thus denominated are the same as those met with as secondary lung affections associated with other acute infectious diseases. It would be better, of course, if there existed a special nomenclature for the changes found in plague pneumonia, but as it is, we must use the general terms of morbid anatomy of the lungs for the characteristic changes which are so pathognomic of plague pneumonia.

In about half of our cases, other manifestations of pneumonia were noticed, namely more or less well-defined patches which showed a homogeneous surface on section without islands of hyperaemic areas, and were situated most often at the periphery but sometimes in the central part of the lung. As a rule, changes in the lung and bronchi were in no way different from the other cases. The pleural changes were the same as those met with in connection with the lobular confluent areas. We are using purposely the term "more or less well-defined" for these areas, because in our cases we could only now and then note the distinct ring of engorgement decribed by Childe and Strong. We rarely found the wedge-shaped patches described by Strong. In every other respect however they were apparently similar to those patches described heretofore. The colour in our cases was often red or greyish red, but sometimes the central portion of whole of the superficial patches was grey.

In 11 of the cases of this group we found more extensive changes in the lungs than those described above. Among these eleven cases three exhibited such changes as the only manifestations of plague in the lungs. In other instances, they were found in combination with the forms of plague pneumonia described above. Rarely, both forms were present in the same lobe. In only two instances were extensive changes noted in two lobes of the same lung. With two exceptions where they were localised in the left upper and left lower lobes, these were found in the right lung. The upper lobe alone was affected five times, the middle lobe alone twice. both upper and lower lobes once, and both middle and lower lobes once. The accompanying table may simplify matters in this respect :—

Localisation of extensive pneumonic areas in group A (11 cases)

No. of P. M.	Sex,	Rt. U L.	Rt. M.L.	Rt. L.L.	Left U.L.	Left L.L.	Remarks,
1	M	1	—	—	—	—	
2.	F	1	—	—	—	—	
5.	F	—	1	1	—	—	Only very small part of the lobes free
6	F	—	1	—	—	—	Only very small part of the lobe free
10.	M	1	—	—	—	—	
12.	M	—	—	—	—	1	Only very small part of the lobe free
13.	F	1	—	—	—	—	
19	F	1	—	1	—	—	Only very small part of the lower lobe free.
21	M	-	—	—	1	—	
23.	M	—	1	—	—	—	
27	M	1	—	—	—	—	

In none of our cases was one lobe completely affected. In four only small portions of the lobes were free from hepatisation. The site of hepatisation in these was distributed as follows :—

(a) right middle and right lower lobes (P. M. 5) ; (b) right middle lobe (P. M. 6) ; (c) left lower lobe (P. M. 12) ; and (d) right lower lobe (P. M. 19). In one of the above cases (P. M. 5), the whole affected area of the middle lobe indicated a stage of grey hepatisation, and stood out fairly well-defined against the adjacent small congested portion. In the three remaining ones, only partially grey hepatisation was present and it was impossible to draw a sharp borderline between the pneumonic and congested parts. In all the other cases, although the pneumonic areas were sometimes rather extensive, a considerable portion of the lobes was free from pneumonic changes. This stood out either in substantial congested masses against adjacent solid areas of pneumonia, or in the form of small tracts of congested tissue unevenly distributed at the margin among the larger hepatised areas.

A whole extensive area in the stage of red hepatisation was seldom present in our list of necropsies. Sometimes grey hepatisation predominated. Sometimes when both stages were present, a zone of grey hepatisation might be seen surrounded by one of red hepatisation. None of the eleven cases differed in other respects from the lobular pneumonic type, with the exception of P. M. 23 which showed an extensive pneumonic area in the right middle lobe. This case also presented a picture which might be mistaken for the lobar type inasmuch as it showed small ill-defined confluent greyish-red areas and a bigger well-defined grey area bordered by a smaller focus of red hepatisation. It did not exhibit the usual pleural changes, however, being covered with a firmly adherent layer of fibrin, beneath which was a whitish thickened pleura devoid of haemorrhages. This condition of the pleura seems quite unique.

Among the female plague cases, such extensive changes as described above were more prominent. This matter will be referred to later on.

Bronchial glands.

In every one of the pneumonic cases we found more or less marked acute changes in the bronchial glands. Although these corresponded in the main with the descriptions given by Strong and Fujinami, it must be stated that in our cases the macroscopical changes did not seem as marked as these noted by the former. A large majority of the glands showed extensive anthracosis, while petechial haemorrhages were in some instances observed. The tracheal glands were sometimes swollen and congested.

The question of chronic tubercular changes in the lungs and bronchial glands will be treated under a separate heading.

The changes in other organs will be grouped together, as only differences of a minor nature were found in the three groups.

GROUP B. CASES WITH SLIGHT LUNG AND PLEURAL CHANGES (5).

Although we do not profess to state that the five cases described her eare widely different from those recounted in Group A, yet they seem to form a connecting link with the cases of the next group and may therefore be treated separately. Of these five cases, the pneumonic changes in two instances were those of a lobular confluent character, while in the other three they were in the form of patches, which were situated peripherally twice and centrally once. The pneumonic areas in these cases were smaller and less well-defined than those mentioned in group A. The visceral pleura remained apparently unchanged. In two instances, some haemorrhages were seen beneath the pleura and away from any pneumonic area. In one case (P. M. 4) a considerable quantity of non-sanguinous fluid containing numerous plague bacilli was found in both pleural cavities. In P. M. 17 the pleura did not show any change, but in both lower lobes a circumscribed area of fine fibrin net was present while haemorrhages were seen over the pneumonic areas. In this specimen also, white irregular areas of broncho-pneumonia could be distinguished in both upper and lower lobes easily visible from the surface of the lungs. Hence this fifth case may be said to possess unusual features.

Regarding the other organs, in two cases the respiratory tract presented the usual swollen and congested appearance. In the other three (P. M. 4, 17 and 31), the changes were noticably less prominent. The mucosa of the larynx and trachea had only a pink colour, there was no bloody froth or sputum but only mucopurulent matter in two cases (P. M. 17 and 31). In P. M. 4 the bronchial mucosa was not as congested as usual. The bronchial glands in all the cases except one adult man (P. M. 31) presented a more or less congested appearance. In this adult case there was considerable swelling due to old caseating masses with no sign of acute changes.

GROUP C. CASES WITHOUT PNEUMONIA OR PLEURAL CHANGES (9).

These nine cases (boy of two years and 8 adults) showed congestion and frequently oedema in the lungs, but no signs of any consolidation due to pneumonia could be found.

Smears taken from the lung substance showed only a few plague bacilli. In one of these cases (P. M. 35) both smears and cultures from the lungs proved negative for Bacillus pestis, while the spleen gave abundant growths of the organism. The pleura in all nine cases was apparently normal; in only two cases could some small haemorrhages be seen beneath the visceral layer.

The upper respiratory tract presented the usual swelling and congestion in only three of the nine cases recorded, while in the remaining six these changes showed slighter variations. No bloody sputum or froth was seen in the larynx or trachea in any of these nine necropsies. Either no contents at all were encountered or, as in four instances, the mucus or froth present was not bloodstained. Smears taken from the trachea, with one exception (P. M. 39, where many plague bacilli were found in the scrapings from the almost dry trachea), showed very few plague bacilli, thus forming a striking contrast to the findings in those cases displaying marked changes in the respiratory tract. Similarly, the macroscopic changes in the bronchial glands were mostly of a trivial nature. The mucous membrane of the bronchi was in every adult case swollen and congested. In the child (P. M. 14) the changes in the bronchi were less marked than usual, though more than in the upper part of the tract. On the other hand, no changes were present in any of these cases, which might suggest another mode of entry of the organism, such as through the tonsils, œsophagus, stomach, or other part of the digestive tract. The general absence of buboes in the cervical, axillary, inguinal and femoral regions was particularly significant. Nor could these be found in a large number of unautopsied corpses brought to the grounds of the hospital during the later weeks of the epidemic although splenic punctures supplied ample evidence of plague. One apparent exception should be recorded, namely, a case where the cervical glands on both sides were swollen; in this, one gland dissected out measured the size of a hazelnut. In this same case (P. M. 36) we noticed a small abscess in the substance of the right tonsil, containing thick pus, but no other changes were observed similar in appearance to the extensive invasion of the mucosa of the fauces as described in one of Fujinami's cases, nor was there any oedema of the glottis as pointed out by Albrecht and Ghon. Smears taken from the tonsillar pus showed but a few plague bacilli mixed with other microorganisms. Neither did our histological examination of this case supply any evidence of primary tonsillar infection.

So Fujinami's case seems to be the only authentic case of tonsillar infection observed in the Manchurian outbreaks, as Koulecha's findings were doubted by all the other authorities.

We regret our inability to report clinically on the cases of this group C. as with one exception the autopsies were performed on unidentified cadavers brought to us from the streets. At that time no fresh plague cases were admitted into the hospital. The exception just mentioned was a man 25 years old (P. M. 39), admitted into hospital the day before his death as a suspected plague case. He had no cough or expectoration, only high fever and rapid weak pulse. The postmortem done on the day of his death showed the same general changes as met with in cases of this group, only there were more plague bacilli in the smears from the trachea, as already stated above. But as this patient did not cough or spit, the presence of a larger of smaller number of plague bacilli in the trachea may not be of special importance from an infective point of view.

Although the histological examination of these cases is not yet complete, there is no doubt that the mode of infection in them was the same as in those cases exhibiting pneumonic lesions, and that between the two groups there exists only a gradual and not an abrupt demarcation.

The above points seem to establish the fact that, apart from the true pneumonic cases accompanied by more or less marked changes in the respiratory tube, there exist not a few cases, where, in addition to the absence of inflammatory changes of a pneumonic character in the lungs, the fauces, larynx, and trachea also show only a slight reaction.

In other words, although the method of entry of the B. pestis in this Group C. as in the Group A. and B. was through the respiratory channel, leading in all cases finally to plague septicemia, at least nine out of total 34 cases (i.e. 26.5%) did not show pneumonic lesions of any sort. Hence the term Pneumonic Plague or Plague Pneumonia as generally applied to this disorder is not strictly accurate, and should be replaced by "Pulmonary Plague" as suggested by one of us in 1911 when acting as President of the International Plague Conference, Mukden.[10] The expression "Pulmonary Plague" would then rightly embrace all the features—non-pneumonic as well as pneumonic—present in this affection.

III. Observations.

These pulmonary cases in the strict sense appeared with scarcely any exception towards the end of the epidemic (see Table II) and in our opinion contributed not a little towards its termination. It may be asked why we came to this conclusion. In the first place, because of the absence of sputum and apparently of cough, these cases during life were far less infectious than those in Group A and B. What factors were responsible then for this evolution of the pneumonic type into the pulmonary type? The first thing to strike one's mind would be a diminished virulence of the organism due to the approach of warmer weather, but this is discounted by three objections. (1) Scientific evidence brought forward at the Mukden International Plague Conference 1911, (2) the prepalence of the epidemic throughout the summer in Vladivostock (May-October 1921) and (3) our own experience of the undiminished virulence of the strains cultivated during the 1921 epidemic and used for animal experiments throughout the summer months.

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[10] Report of International Plague Conference, Mukden, 1911.

It is possible that this transformation from the pneumonic to the pulmonary type might be due principally to the *enhanced* virulence of the Bacillus pestis at the height of the epidemic, so that the patient succumbed before any gross anatomical changes could develope. In fact the organisms having successively passed through their human hosts were becoming so virulent, that there seemed to be little or no time for the latter to develope pneumonia. As a consequence the principal medium of infection, namely the sputum, was absent.

Again, the later victims became less infective though invaded by more virulent bacilli, and fewer infections therefore took place, which were apparently of the pulmonary type described above. These pulmonary cases proving less and less infectious, the epidemic gradually withered away.

The one exception showing a pulmonary and not a pneumonic lesion which occurred in the middle part of the epidemic was that of a two year old child (P. M. 14). In this case, the tongue, larynx, and trachea showed very slight reaction, while the lungs were œdematous and congested with no pneumonia. This condition could be explained by there having been insufficient time for the development of pneumonia owing to the high toxicity of the invading organism and the diminished resistance of the patient. Should any future epidemic of plague pneumonia occur, this question of differentiation between the pneumonic and pulmonary types might be more fully investigated. In this connection we may state more fully investigated. In this connection we may state that we propose to continue our inhalation experiments upon tarbagans and other animals in 1922 with a view to the further elucidation of this rather obscure problem.

IV. Findings in other organs.

The morbid anatomy of the remaining organs in all the these groups comprising 33 cases (the stillborn excluded) may be conveniently described together, as there are no marked differences between them in this respect. Our findings in this epidemic confirm on the whole with those of the 1910-11 outbreak, hence this part of our report will be necessarily brief.

Pericardium, Heart and Bloodvessels.

We noted in 11 of our cases (almost exclusively those with marked pneumonic changes) the presence of fluid in the pericardial sac. In one of these, there were almost 400 c.c. of clear fluid in the sac, dislodging the heart considerably from its normal position. As in the case of pleural exudate, the pericardial fluid was rarely tinged with blood. It was sometimes cloudy, though more often it remained clear, and plague bacilli could in most cases be cultivated as well as seen in smear preparations. We detected haemorrhages of varying size in the parietal layer in ten, and in the visceral layer in nine out of our 34 cases. In only four instances were haemorrhages found in both parietal and visceral layers of the same pericardium.

The right chamber of the heart was in almost all cases distended with blood, the right auricle being often quite thin from dilatation. In one case (P.M. 11) the heart was unusually contracted. The cardiac muscle was invariably softer than usual, and indicated cloudy swelling and sometimes early fatty degeneration. The large bloodvessels showed little or no acute change. In P.M. 4 (child of 3 years) some petechiae were noticed beneath the intima of the tricuspid valve.

Alimentary Tract.

Contrary to previous observations, we not infrequently found some slight congestion in the oesophagus. Out of 33 cases recorded 23 were normal. Of the remaining ten, seven showed slight congestion in the lower third, one in the middle, one in the upper part, while the tenth was hyperaemic along its whole course. The pharynx being practically always affected, the sharp line of demarcation between this congested part and the pale oesophagus was quite characteristic.

The mucosa of the stomach was often slightly swollen. Haemorrhages of varying extent were frequently present, but no other acute changes could be detected.

With regard to the intestines, the peritoneal coats showed haemorrhages in only a few instances. Hyperaemia was often noted in the mucosa of the small and large intestines. In some cases both coecum and ileum showed ecchymoses in the submucosa. Cultures of B. pestis were successfully obtained from the congested areas of the intestinal mucosa in two instances, while the faeces from the coecum in another case gave positive smears. The mesenteric glands in over 21% of the cases were swollen and congested. The parietal layer of the peritoneum was generally free, but in one case (P.M. 21, aged 61) we noted both congestion and haemorrhages in this region.

Spleen.

The spleen was found distinctly enlarged in 71% of our cases as compared with 56% of Strong's. In a further 19%, slight enlargement was recorded. Although the spleen was usually firmer than in other infectious diseases, as pointed out by Strong, in a quarter of our cases the organ was soft and flabby, even breaking into two or more pieces when extracted from the abdominal cavity. This flabby condition and increased size of the organ were apparently more marked in the later pulmonary than in the earlier pneumonic cases. Until the histological examination is completed, it would perhaps not be advisable to over emphasize these features. Haemorrhages beneath the capsule were seen in two cases. When cut, the splenic pulp was found to be darker than normal, while the follicles were visible in at least half of the cases. In one case (P.M. 11, man who died after an illness of nine days) a small white infarct measuring 7-8 mm. across was found at the lower border of the spleen.

Liver.

Cloudy swelling or distinct fatty degeneration was noted in all cases. In about half of these, we observed lying beneath the capsule yellowish white patches, more or less circumcribed from the rest of the tissue. These patches varied in size from 1½ to 2½ cm. on the surface, while on section they measured 1 to 2 cm. deep. They were very rarely situated in the interior of the organ away from the surface and were apparently the results of acute toxic changes produced by the B. pestis. The patches varied in number, several being often found in the same organ.

In three cases the liver presented a nutmeg appearance. The microscopic examination will ascertain whether this is due to "acute degeneration of the liver cells around the hepatic veins, and not to a chronic venous congestion." (Wu and Woodhead). Haemorrhages beneath the capsule of liver were seen in 8 out of 34 cases, 5 being pulmonary and 3 pneumonic.

Pancreas.

This was rarely swollen, only slight hyperaemia being seen in a few cases. In one case some haemorrhages were noted in the substance of the organ.

Lymphatic glands in general.

Beyond the changes already noted in the bronchial, tracheal and mesenteric glands, nothing of an unusual nature was found in the other lymphatic glands. In a few cases, there was slight enlargement and congestion of the glands of the neck. The unusual case of a distinct cervical swelling found in P.M. 36 has already been mentioned.

Thyroid, Thymus and Adrenals.

No peculiar changes were seen in the thyroid, except slight congestion in a few instances.

In the case of the thymus, we were interested to note that in more than half of our cases the organ was persistent in the adult bodies, sometimes reaching a remarkable size. But inasmuch as this gland was apparently persistent also in a smaller, though a fair percentage, of non-plague bodies examined by us, it will perhaps be advisable not to lay undue stress upon this phenomenon, the more so more as recent literature conveys warnings not to exaggerate the importance of the *status thymicus*. The matter, however, deserves further study by both anatomists and pathologists in China.

The adrenals presented no marked naked-eye changes. The centre of the gland was sometimes found empty so as to produce a *cul de sac*, but no special importance need be attached to this point as it is present in a majority of normal autopsies.

Urinary and Sexual Organs.

Our findings in the kidneys corresponded closely with those of former observers. The cortical bloodvessels were often considerably dilated. Actual haemorrhages were seen on seven occasions beneath the capsule and on eleven occasions in the pelvis of the organ. The urinary bladder also showed haemorrhagic points in a few cases. Cultures taken from the cavity of the pelvis, ureter and bladder (the latter drained in some instances by catheter) gave as a rule positive results for B. pestis. On the other hand, with one exception, urine voided by thirty living patients proved negative for this organism, when cultivations were made. No further changes beyond congestion were apparent in the male and female sexual organs. Positive cultures were obtained in some instances from the testis as well as the vaginal portion and the cavity of the uterus.

Central Nervous System.

The brain showed marked congestion, the subdural vessels being often enormously dilated. Oedema of the cerebral hemispheres was sometimes present. The cerebrospinal fluid was clear and gave as a rule positive bacteriological findings, The petrous portion of the temporal bone was removed in several cases for more minute investigation.

Tuberculous Lesions found in Plague Cases.

The incidence of plague in tuberculous subjects was specially discussed at the Mukden Plague Conference (1911). Strong made 25 complete necropsies at Mukden and did not find a single tuberculous lesion. Fujinami performed 26 human plague *postmortems* and found a few lymphatic glands affected with TB and only one case where the lungs showed any TB lesions. Koulecha made 28 autopsies and did not mention TB. Haffkine said he found calcareous nodules in 3 cases of plague pneumonia.

In view of the apparent rarity of Tuberculosis among plague-victims, special care was taken by us to ascertain its presence in our cases. The following are the findings among 34 necropsies :—

a. Lungs.

	Marked Pneum. *Group A.*	*Slight Pneum.* *Group B.*	*Pulmon. Cases.* *Group C.*	*Total.*
Active lesions	1	—	—	1
Latent ,, ...	4	—	1	5

In the only active case seen—a well-developed but not fat old man of 61—there was no cavitation, only a confluent granular tuberculosis of the right apex with many calcified nodules in other parts of the same lobe. The case was evidently one of benign character, often seen in persons of advanced age.

The five latent cases showed only induration and calcification and no recent changes.

b. Peribronchial Glands.

	Marked Pneum. *Group A.*	*Slight Pneum.* *Group B.*	*Pulmon. Cases.* *Group C.*	*Total*
Acute changes	1	1	—	2
Latent ,, ...	2	1	—	3
Doubtful	—	—	1	1

The two acute cases showed distinct caseation throughout the affected glands, while the latent cases had some calcifications. The doubtful case appeared to possess a few suspicious areas of softer consistence. These will however require the help of the microscope before a definite conclusion can be reached. It is quite possible that such an enquiry will reveal further cases at present undertermined.

c. Pleural Adhesions.

	Marked Pneum. *Group A.*	*Slight Pneum.* *Group B.*	*Pulmon. Cases.* *Group C.*	*Total.*
Extensive	4	1	5	10
Slight	6	1	1	8

d. Changes in Other Organs.

i. One case of scrofuloderma over lower part of chest was seen (P.M. 7).
ii. One case had rather extensive adhesions in the upper part of the peritoneum (P.M. 29).
iii. Over the front of the epicardium in another case were seen two milk spots (Sehnenflecke) each the size of a sixpenny piece. It is possible this may be of rheumatic origin.

Remarks.

To summarise, we had four cases of active Tuberculosis (one in lung, two in glands and one in skin) in addition to a doubtful gland case. 18 cases of pleural adhesions were noted, apparently tuberculous. The above findings were distributed among 20 cases altogether.

Compared with our usual out-patient records, where the percentage of active tuberculous cases was considerable (for instance, Harbin Hospital reports for 1918-21 enumerated 993 of TB lungs, 926 TB skin, 580 TB bone and 3050 TB glands, i.e. a total of 5549 TB cases out of 39,819 patients treated) this scarcity of tuberculous lesions in plague victims may seem somewhat inexplicable, unless we take into consideration the following factors :—

i. Plague patients came principally from the strong ricksha pullers, day coolies, etc., who were crowded in dusty dark inns, where they received plague infection.
ii. Patients suffering from chronic complaints, like Dysentery, Phthisis, etc., were often turned out of

the inns during the epidemic and sought admission into our general wards. When these died no *post-mortems* were made upon them.

iii. Our plague autopsies were performed upon patients who had died in the Hospital up to the end of the epidemic when, owing to the absence of admissions into our hospital, all dead found in the streets were carted into the hospital compound, and the necessary necropsies made for diagnosis. Among the latter cases many morphine subjects were found, who at the *post mortem* revealed many pleural adhesions.

It seems therefore inadvisable to lay undue stress upon the comparative absence of acute tuberculous lesions among plague cadavers.

Incidence of Age and Sex (see Table II).

The only *postmortem* performed upon an old person was P.M. 21, aged 61, showing marked pneumonia and pleural changes. In this aged subject, we noticed no striking changes in the viscera as compared with those in younger bodies.

We autopsied, beside the stillborn, the bodies of 6 children below ten years. Attention has already been called to three of these. The other three children also exhibited no unusual features.

Regarding the six adult females, all showed considerable pneumonic and pleural changes and were hence classed under Group A. In five, extensive pneumonia was present. No other differences were noted.

V. Special case of Mother and Stillborn.

a. A woman aged 31 years, pregnant for the fourth time, was sent to hospital with fever as a suspect on morning of 22. March from the isolation wagons, where she was lodged after her husband had been attacked by plague. When admitted into hospital, she was coughing up blood, in which plague bacilli were found. In the afternoon, the patient became worse and towards evening gave birth to a full-term female child. The mother died early next day. The *postmortem* upon the mother showed plague-pneumonia, with the following summary of findings:—P.M. 9, woman, mother of stillborn, died 23rd March, 1921. P. M. soon after.

Well built woman, age 31. Cyanosed face.

Tongue slight red; *Tonsils* swollen and congested. Papillae of *pharynx* show similar changes.

Larynx and Trachea much congested, little mucus.

Lungs. Anterior surface showed film of semipurulent mucus, emphysematous.

Right upper lobe pneumonic patch. Bronchopneumonia in right lower lobe. Rest congested.

Left lung markedly congested, no patches.

Peri-bronchial glands swollen and anthracotic.

Right upper lobe, pneumonic patch. Bronchopneumonia

Heart. Much clear pericardial fluid. Much enlarged, Coronary vessels enlarged, aorta normal.

Diaphragm. Many haemorrhages, specially over liver area.

Liver. Swollen; marked fatty degeneration. White patches especially on right side.

Spleen. Enlarged, much congested.

Kidneys. Right much enlarged and congested with cloudy swelling; pelvis filled with urine.

Left same, only slightly less marked.

Cortical vessels enlarged and congested.

Uterus. Much enlarged, not reduced after labour. Many big clots inside. Haemorrhages on surface of uterus and left ovary.

Ovaries, tubes and ligaments congested.

Microscopical examination.	*Smears.*	*Cultures.*
Heart	+	+
Lung	+ +	+
Pericard. fluid	+	+

b. The stillborn baby was autopsied on the 23rd of March. Pathological notes taken were as follows:—

FULLTERM FOETUS. No external lesions were noted on the body, skin was pale and showed no petechiae or ecchymoses.

The Placenta was still attached through the umbilical cord to foetus. Both placenta and cord showed no gross changes. Smears from the former showed many B. pestis, culture was positive but mixed with other organisms.

Slight caput succedaneum. Some bloody fluid in the subdural space. Films taken from this showed no B. pestis, but culture was positive though mixed.

In dissecting out the brain, interior of occiput was found much congested, especially the fontanelle.

Brain was congested. Cerebrospinal fluid taken from the fourth ventricle was clear and gave positive results in smears and culture. The mucous membrane of the *tongue* and *pharynx* was neither swollen nor congested. The tongue showed some haemorrhages at the back near the fauces. The *tonsils* were slightly congested. The *larynx* was markedly congested. There were haemorrhages below the vocal cords, more marked beneath the mucosa of the laryngeal side of the epiglottis.

Trachea and Bronchi were of normal appearance. Frothy mucus was present in both main bronchi.

Both *Pleural cavities* contained some non-sanguinous liquid, giving positive plague cultures. *Lungs* had no air in the alveoli and were much congested. Haemorrhages were seen between upper and lower lobes of both lungs as well as on outer aspect of the left lung, where they were arranged in confluent stripes. Culture from the lung was positive.

Peribronchial glands were apparently unchanged.

Some haemorrhages were noted beneath the visceral layer of the pericardium, also on the mediastinum.

Heart was distended, especially in the right chambers and filled with clots. Some fresh vegetations were noted on the bicuspid and tricuspid valves. One large and a few small haemorrhages were seen on the pulmonary valves, beneath the intima of aorta and of pulmonary artery. Smears and cultures taken from both chambers gave positive results.

Liver seemed congested. Fine haemorrhages were present in the wall of the gallbladder and beneath the neighbouring liver capsule. Smears and cultures from the liver were positive.

Spleen was firm and congested but not enlarged. Smears from it showed many B. pestis, but cultivations remained sterile.

Both *Kidneys* were congested, and cloudy swelling was not marked; no haemorrhages in the pelvis. Smears taken from both ureters were positive, while the cultures showed plague bacilli mixed with other organisms.

Oesophagus was normal.

Peritoneal cavity contained much bloody fluid, giving positive findings in smears and cultures.

The mucosa of the *Stomach* was slightly swollen and congested, expecially near the pylorus. Normal meconium was observed in the large intestine.

Bladder contained urine; its surface vessels were slightly enlarged and the mucosa was somewhat congested.

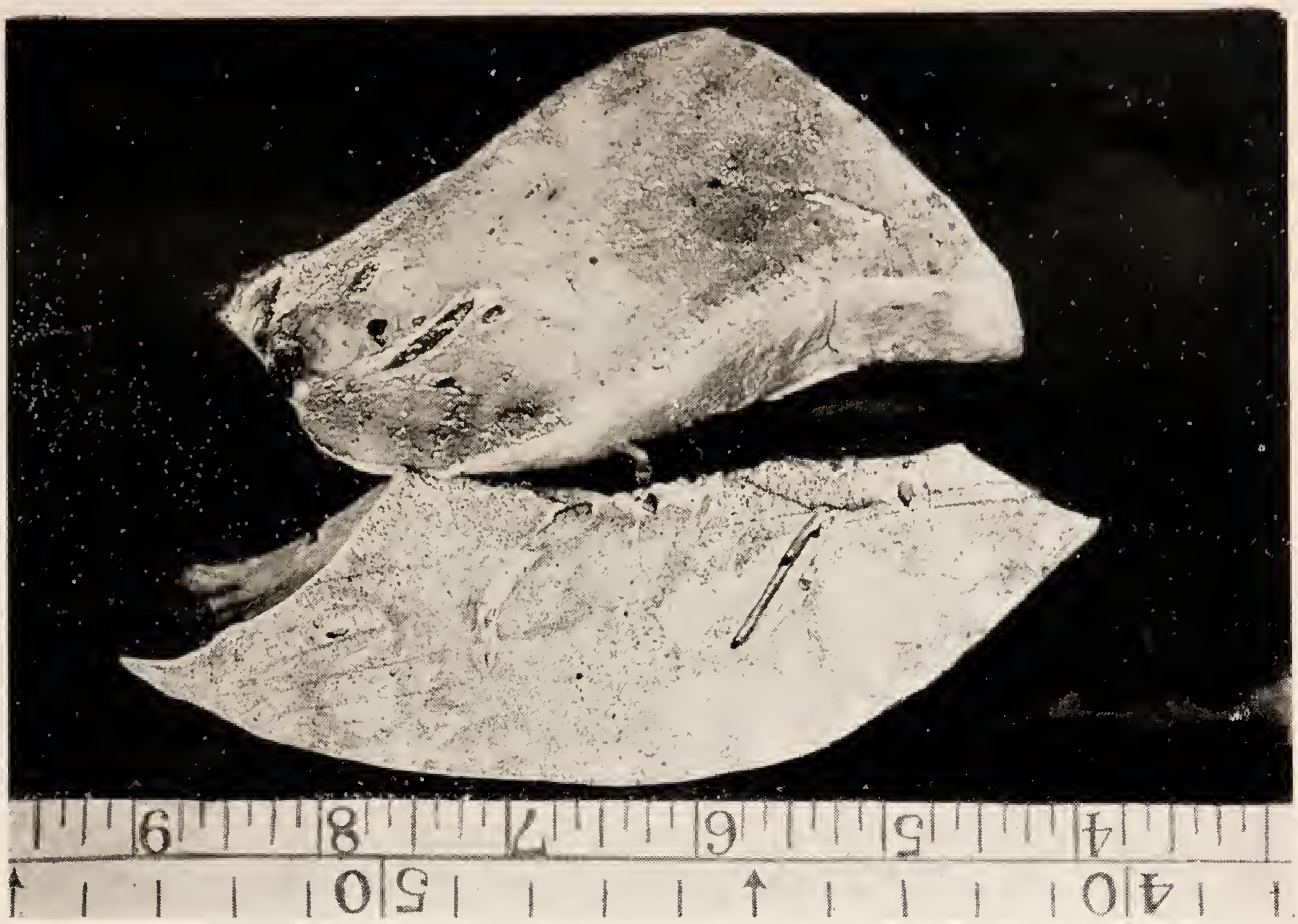
Uterus seemed normal. Smears and culture taken from its cavity showed plague bacilli.

The results of the histological examination of this unique case will be given under our histological findings.

TABLE I.

DISTRIBUTION OF PNEUMONIC AREAS IN LOBES OF LUNGS.

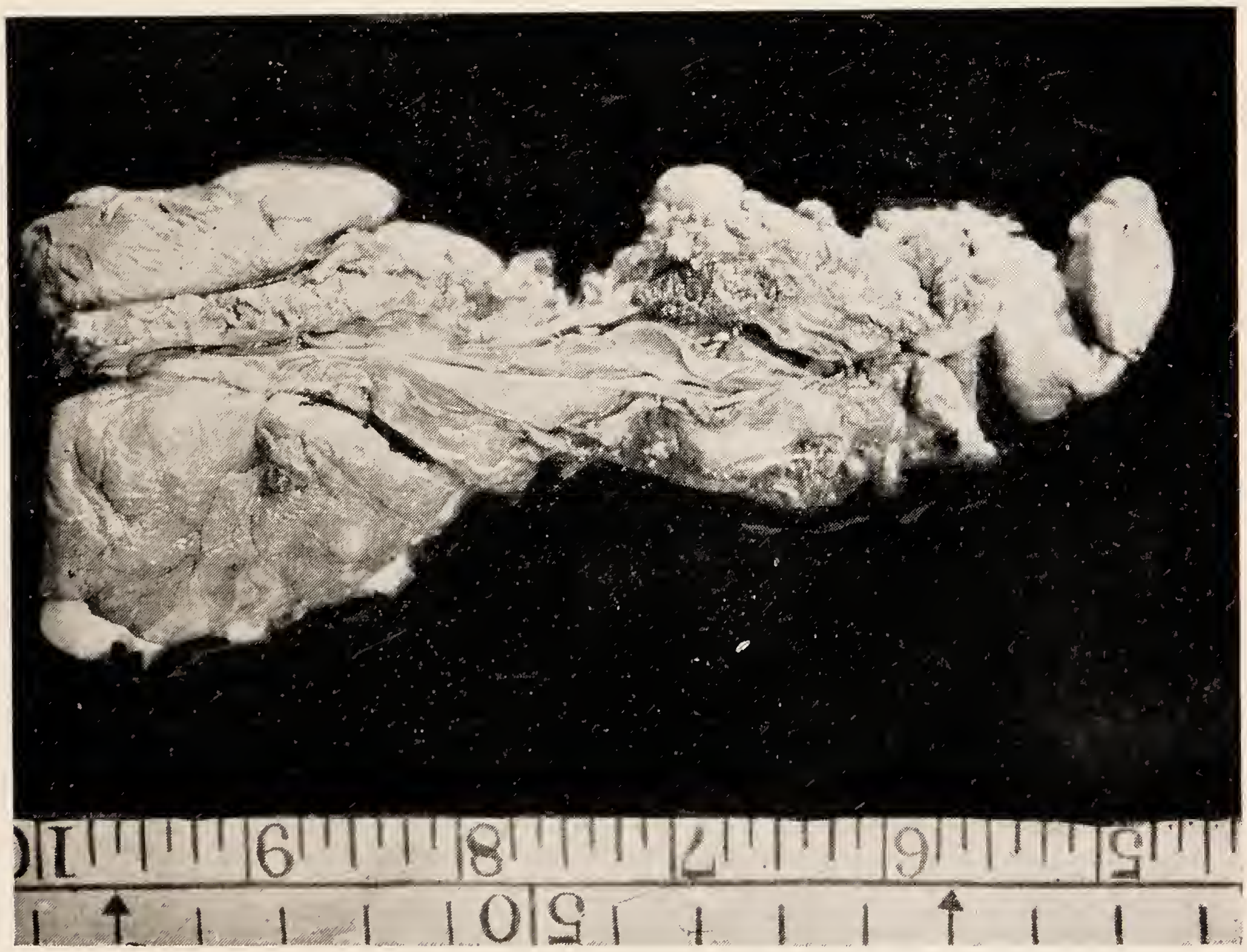
No. of P.M.	Age.	Sex.	Rt. U.L	Rt. M.L.	Rt. L.L.	Left U.L.	Left L.L.	
1	Adult	M	Extensive area	—	Lobular confl.	—	—	
2	16	F	Extensive area	Lobular confl.	Lobular confl.	Lobular confl.	Lobular confl.	
3	22	M	Patch	—	Lobular confl.	Lobular confl.	Lobular confl.	
5	22	F	Lobular confl.	Extensive area	Extensive area	Lobular confl.	Lobular confl.	
6	17	F	—	Extensive area	Lobular confl.	—	Central Patch	
7	8	M	Patch	—	—	—	—	
9	31	F	Patch	—	Lobular confl.	—	—	
10	35	M	Extensive area	—	—	Lobular confl.	—	
11	Adult	M	Central patches	Patches	Lobular confl.	Patches	—	
12	10	M	—	—	—	—	Extensive area	
13	24	F	Extensive area	—	Central patch	Patches	Lobular confl.	
16	24	M	Lobular confl.	—	Patch	Patch	Central patch	
18	14	M	—	—	—	—	Lobular confl.	
19	24	F	Extensive area	Lobular confl.	Extensive area	—	—	
20	5	M	Patch	Early lobular confl.	Lobular confl.	Patch	Patch	
21	61	M	—	—	—	Extensive area	—	
23	Adult	M	—	Extensive area	Lobular confl.	Patches	Patches	
27	24	M	Extensive area	—	—	—	—	
32	25	M	—	—	—	—	Patch	
4	3	F	—	—	Central patch	—	Central patches	
17	1	M	Patch	—	Patch	Lobular confl.	Lobular confl.	
22	41	M	Patch	—	—	—	—	
28	Adult	M	Lobular confl.	—	Lobular confl	Lobular confl.	—	
31	40	M	Early lobular confl.	—	Early lobular confl.	Lobular confl.	—	



Upper { Section of right middle lobe of lung (P.M. 23) showing extensive pneumonic areas.

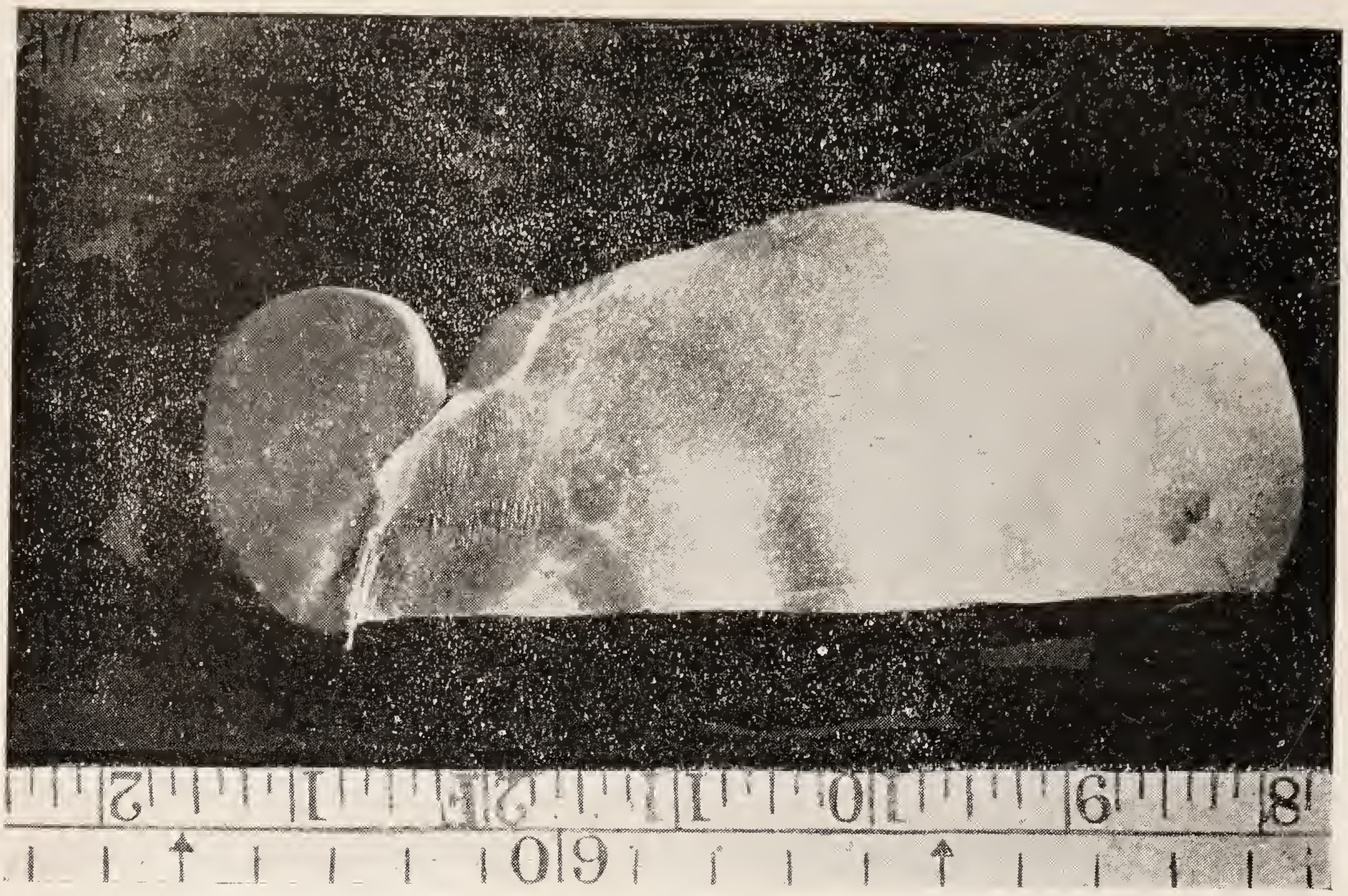
Lower { Section of Lower Lobe of Right Long (P.M. 23) showing different confluent areas of pneumonia arranged round the ramifications of one small bronchus.

上圖　右肺中葉一部（解剖二三號）
下圖　右肺下葉一部（解剖二三號）



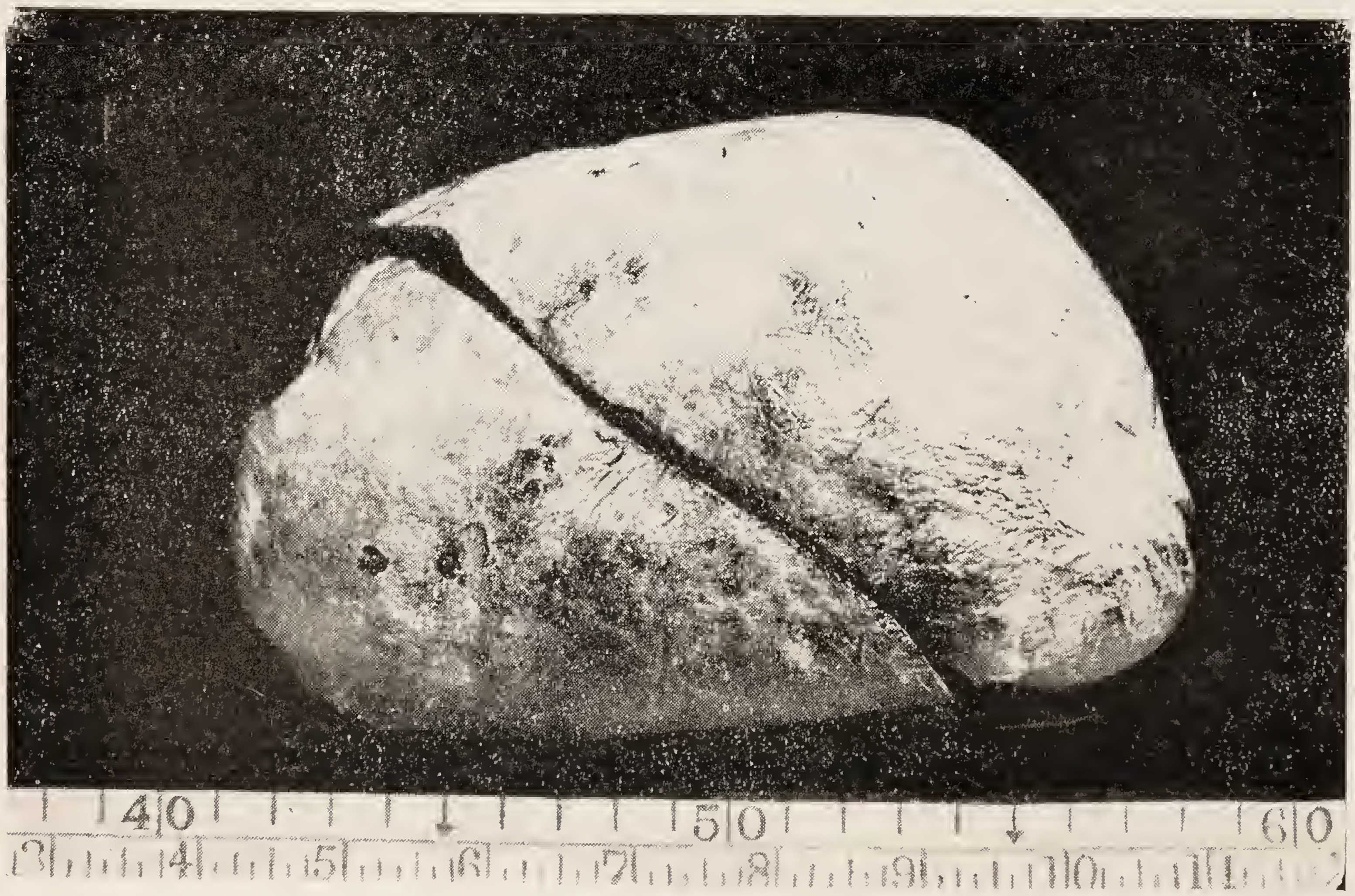
Viscera of Tarabagan 7. Posterior view, showing small abscesses in both lungs. This Tarab. was killed by us on 17th day after receiving inhalation of B. pestis. Microscopic exam. and cultures from abscesses showed only a few organisms.

獺亡示小膿瘍分佈兩肺圖



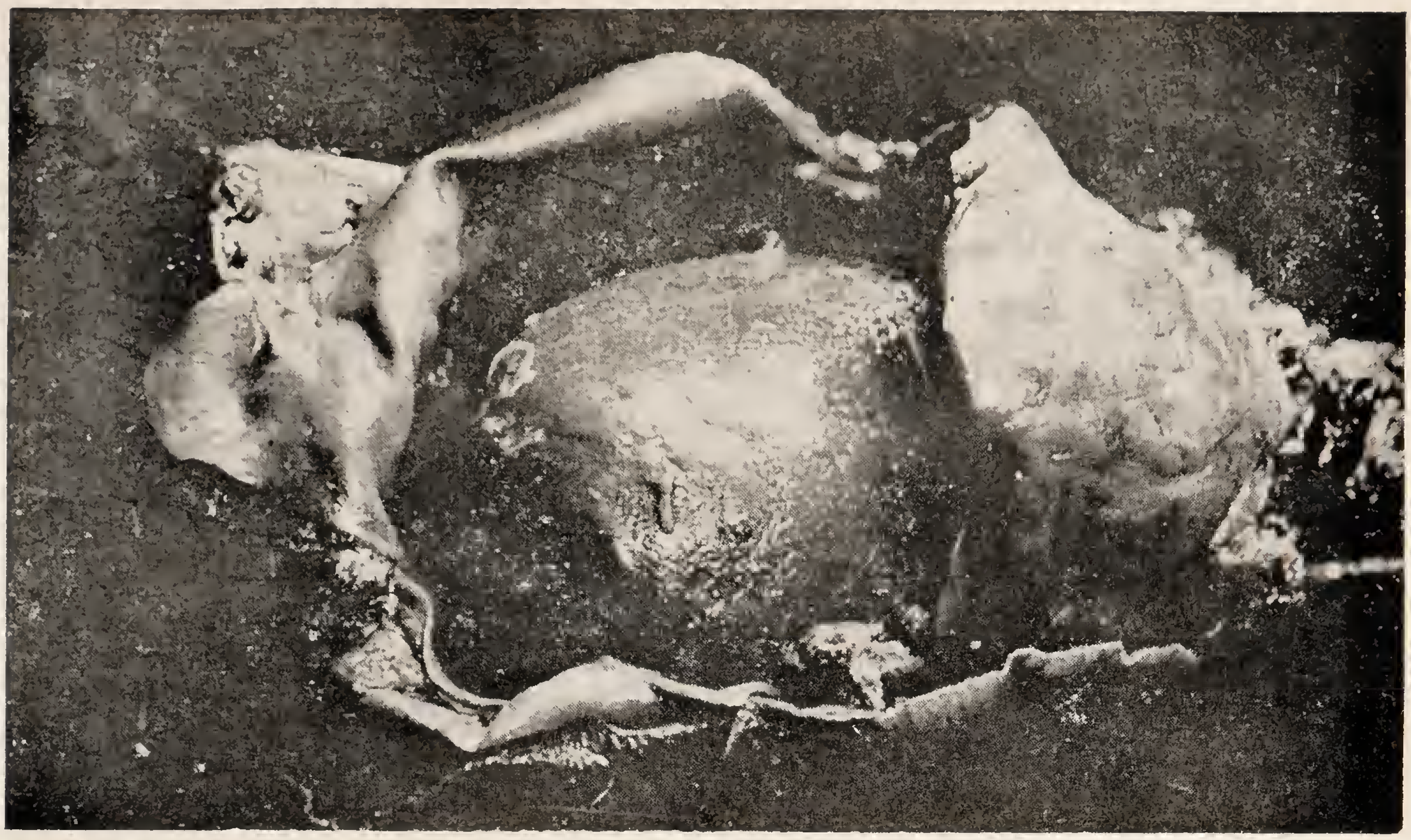
Liver human (Pnuem. Plague) showing white patches.

人肝臟(肺炎鼠疫)示白色病區域



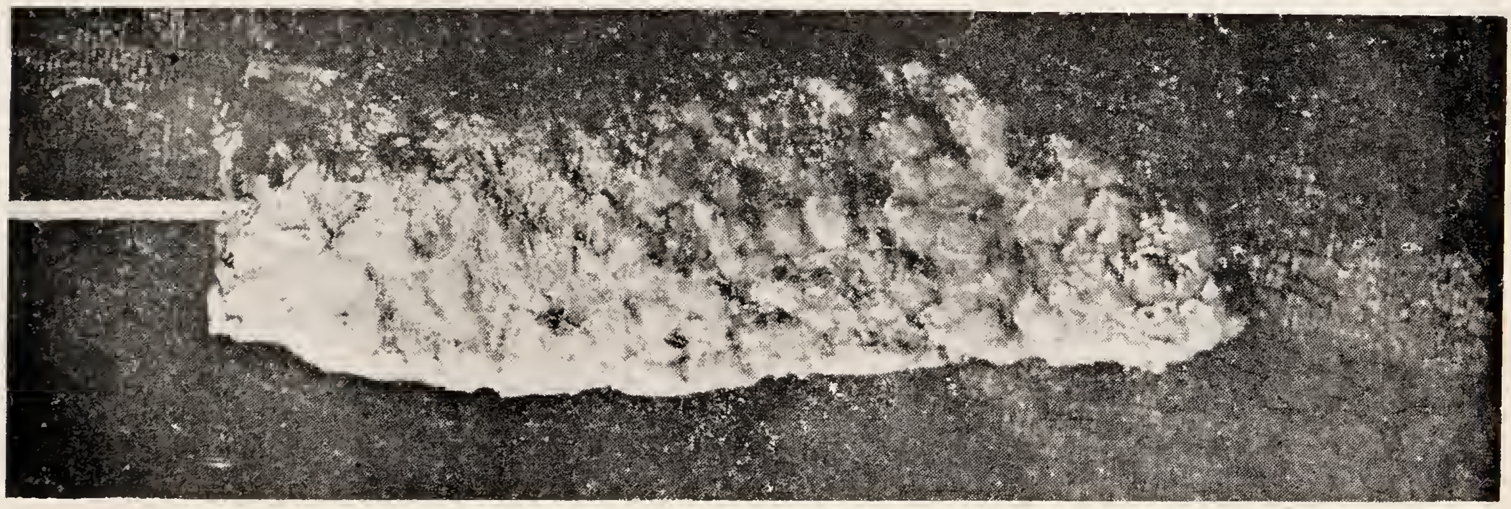
Posterior Surface of Left Lung (P.M. 23) showing multiple haemorrhagic patches representing Lobular Pneumonia.

左肺後面示出血區域小葉肺炎



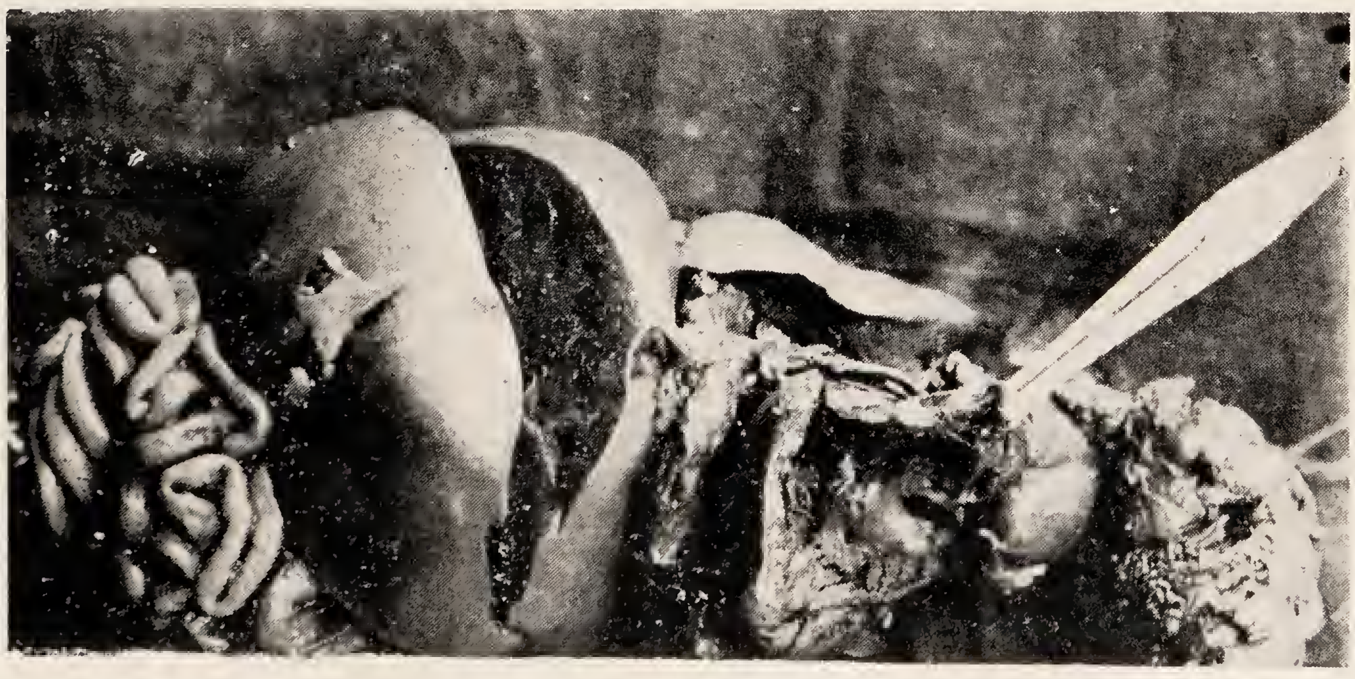
Heart of Tarabagan contact in inhalation expt. which died 6 months after showing pericarditis.

旱獺心囊炎之狀況



Spleen of rabbit which died of Chronic Plague in 19 days, showing multiple nodules throughout.

慢性鼠疫兎之脾臟示結節分佈狀況



Viscera of Still-born (P.M. 8) showing fresh vegetations on bicuspid and tricuspid valves of heart.

鼠疫死胎（解剖八號）圖

TABLE II.

LIST OF P. MS. SHOWING CONDITIONS OF LUNGS IN PLAGUE PNEUMONIA.

No. of P. M.	Age.	Sex.	Sex	Marked Pneum. & Pleuritis	Slight Pneum. & Pleuritis	No Pneum. or Pleuritis	Remarks
1	Adult	M	Feb. 27	1	..	..	
2	16	F	Mar. 3	1	..	..	
3	22	M	,, 4	1	..	..	
4	3	F	,, 8	..	1	..	Child 3 years
5	22	F	,, 8	1	..	..	
6	17	F	,, 14	1	..	..	
7	8	M	,, 18	1	..	..	
8	STILLBORN	F	,, 23	..	..	1	Stillborn.
9	31	F	,, 24	1	..	..	Mother of above
10	35	M	,, 24	1	..	..	
11	Adult	M	,, 25	1	..	..	
12	10	M	,, 30	1	..	..	
13	24	F	Apr. 5	1	..	..	
14	2	F	,, 5	..	..	1	Child 2 years
16	24	M	,, 12	1	..	..	
17	1	M	,, 12	..	1	..	Child 1 year.
18	14	M	,, 19	1	..	..	
19	14	F	,, 23	1	..	..	
20	5	M	,, 23	1	..	..	
21	61	M	,, 24	1	..	..	
22	41	M	,, 27	..	1	..	
23	Adult	M	May 1	1	..	..	
27	24	M	,, 13	1	..	..	
28	Adult	M	,, 13	..	1	..	
29	35	M	,, 14	..	..	1	
30	Adult	M	,, 16	..	.	1	
31	40	M	,, 16	..	1	..	
32	25	M	,, 17	1	..	..	Had only one patch.
33	26	M	,, 17	..	..	1	
34	Adult	M	,, 17	..	..	1	
35	35	M	,, 19	..	..	1	
36	25	M	,, 19	..	..	1	
37	30	M	,, 20	..	..	1	
39	25	M	,, 21	..	..	1	
Total		25 M 9F		19	5	10	Incl. stillborn

SALIENT POINTS ABOUT THE 1921 PNEUMONIC PLAGUE IN HARBIN.

by

J. W. H. Chun M.B., B.C. (Cantab), M.R.C.S., L.R.C.P.

PREAMBLE.

The first pneumonic plague epidemic in Harbin occurred in the winter of 1910-11, lasting from November to February, when a mortality of 9000 was recorded. The population in Harbin then was some 80000, so the death rate from plague may be said to be approximately 90 per thousand.

In 1921, the first case of pneumonic plague occurred on the 22nd January, and the last case appeared on the 23rd May with a total of 3125 deaths. The present population of Harbin may be put down as 300000, thus bringing the plague death rate down to 10 per thousand.

Further, ten years ago, the plague mortality amounted to 50000 in the whole of Manchuria, while this year the total number of deaths in the same area come to 8500 only.

The bacillus pestis was noticeably just as virulent as ever in 1921, for no true pneumonic plague case recovered; the sanitation and popular ideas with regard to hygiene have not appreciably advanced; also the means favouring the spread of this highly infectious disease, such as rapid railway communication, still exist as before; further the military control, formerly furnished by Russian soldiers in part, now devolved entirely on Chinese soldiers, and they were hostile to strict antiplague measures, so far as the rank and file were concerned. Taking all these into consideration, the large reduction in plague deaths is the more remarkable when the increase of population in Manchuria during this period of ten years is reckoned as a factor.

This wonderful change may shortly be assigned to three causes, namely, the existence of a permanent antiplague service, the willing and enthusiastic support of the Chinese authorities, and the active cooperation of the Chinese Eastern Railway and the Russian doctors.

At the beginning of the epidemic, first reported in Hailar, October 1920, the Chinese officials at once took a serious view of the matter and invited the Plague Prevention Service to cooperate with the Russian doctors with such good effect that only 54 deaths were recorded.

Unfortunately some men took the disease to the Dalainor coal mines some hundreds of versts west, and from there Manchouli itself was infected. Passengers travelling eastwards to Tsitsihar caused an epidemic there also, while others brought it to Harbin where the first case was observed on the 22nd January.

It was fully realized that Harbin might be infected any time, so measures were taken early against this danger. The train service between Manchouli and Harbin was restricted to first and second class passengers who were first examined by doctors before tickets could be purchased. The number of tickets was also limited and no third class passenger tickets were issued. In spite of this, coolies managed to steal rides on goods trains and secure passes in other ways.

How the First Cases were Managed.

The first pneumonic case was discovered living near the hospital. A man, formerly a miner at Dalainor, came from Manchouli to Harbin to join his aged mother, sister and sister-in-law. After positive diagnosis was established, three contacts were housed in our compound. Of these three contacts, one woman, the sister-in-law, developed plague on the 5th day of sojourn. The rest were well, and set free subsequently. After this, other plague deaths were reported in the town, day after day.

As the number of plague cases increased, 10 trained dressers were stationed at the 5 districts to take charge of the inspection squads, to superintend the sending of plague cases to the hospital, to send for the disinfecting squad, and to arrange for the quarantine of the contacts.

The police were a great help and did their duty on the whole nobly. The town of Fuchiatien was divided into 5 districts and inspectors went round daily. All sickness and deaths were reported to them who in turn notified the hospital, and a doctor would go and do spleen punctures in corpses or secure sputum for diagnosis from the suspiciously sick. At first contacts also were housed at the hospital, but later they were isolated in box-cars kindly lent by the Chinese Eastern Railway.

Referring to the drawing, it may be noticed that as a sick man was admitted, he was placed on a bed near the gate where the doctor and dresser could examine him. If it was a case of plague, he was taken by stretcher to the plague ward where he remained by himself in a room. If it was a suspicious case, he was taken to the suspect ward, also in a room by himself. If, on the other hand, it was a case of ordinary sickness, he was sent home. Each man on admission was questioned as to his name, occupation, age, address, how long he had been sick, and if there were any contacts. Any valuables and money were taken care of by the dresser in charge.

These particulars set down on a temperature chart were pinned on the door of his room and the result of his stay was was also put down later. The drawing will show that the cubicles communicate with one long corridor. Each cubicle is provided with an observation window, and the inmates could thus be seen from the corridor without opening the doors. Near the gate were stationed ten policemen and they took turns to be on duty to guard against the escape of the inmates of the hospital. Next door to this was the disinfection room where the staff might put on the antiplague garments, where antiseptics were stored, and where hot water was to be had.

The hospital was open at all times of the day and night.

HOW PLAGUE WAS DIAGNOSED.

As soon as the patient entered the gate and after his history was taken in the open air, he was asked to spit into an earthern basin and if there was blood in the sputum, if he had fever, if his facies resembled plague and especially if he staggered in his gait, he was presumed to be a plague case and would he sent to the plague ward. In case of doubt, the sputum was collected in a Petri dish which was put inside a round tin case and carried in an rectangular tin box having the capacity for 4 Petri dishes and taken to the laboratory for microscopic diagnosis.

If the patient did not spit up blood but had fever, he was sent to the suspect ward. As the diagnosis of the different cases became clear, the patients were either sent to the suspect ward, or plague ward, or set free, or sent to the isolation wagons according to circumstances. In this work, our bacteriologist, Dr. Pollitzer, took great pains at all times to ensure the right findings. Many other conditions were sent in by mistake, but were diagnosed and kept temporarily in wards separate from the plague wards. Enumeration may be made of morphine maniacs, simple catarrhal fevers, pneumonia, empyema, drunkenness, influenza, Bright's disease, tuberculosis of the lung, rheumatism, heart disease, starvation, typhoid, paratyphoid, erysipelas, diarrhoea, dysentery, tuberculosis of bones, etc. Whenever possible, these were sent home to make room for real plague cases.

As a rift in the cloud, one may relate an amusing instance of mistaken diagnosis on the part of the inspection squad. One man ate crab apples, and spat out some red pulp. He was thought to have spat up blood and was sent to the hospital, happily to be discharged soon after.

STAFF.

One doctor was in charge of the plague hospital. Under him were three dressers. One dresser took care of the clerical part of the work, the second had charge over the personal effects of the patients, the procuring of the sputum and urine, etc., as well as other odd jobs, and the third had charge of the patients themselves.

There were one cook and one washerman whose duty included the disinfection of gowns, hoods, etc., by formalin-gas. There were also two attendants who looked after the welfare of the patients themselves. These two men had the dangerous work of feeding the patients, providing them with water, bringing earthernpots for sputum and evacuations, and cleaning the wards generally.

A sanitary squad consisting of ten men also formed part of the staff, to convey patients by stretchers when transference was necessary, to remove the corpses to the cremation pit inside the compound, and to cremate the corpses. At the beginning of the epidemic these men had to go out into the town to cart away plague corpses to the public burial ground. As the number of corpses increased towards the height of the epidemic, other sanitary squads were formed in the town itself for this purpose. As has already been mentioned, ten policemen were detailed on duty day and night in the compound.

It may be realized that work of this nature was highly dangerous. So much so that a very keen and able worker, Dr. Yuan Teh Mao, died of this dread disease. Two attendants, three members of the sanitary squad and one policemen also succumbed.

HOW THE STAFF WAS PROTECTED.

Some members of the staff were inoculated against plague with vaccine. The greater proportion, however, were not thus inoculated. Great reliance was placed on the mask, over-all, hood, high boots and rubber gloves. After the mask was tied in place, the hood was put on, and goggles were worn outside the hood. Then came the overall, and lastly the rubber gloves. The hood may be briefly described with advantage. It was shaped something like a bag with two holes for the eyes. It was made of ordinary white cloth, and a piece of Chinese silk was sewn on the nose and mouth area with the idea of extra protection for those parts.

On coming out of the ward, the overalls, etc., were removed and hung in the sun and open air. In the evening, the garments were disinfected by formalin gas and would be ready for use the next morning. The boots were sprayed with Izal lotion. A thymol gargle was provided and the hands were washed in Izal lotion. A special suit of clothes was worn when on duty, so that when the day's work was over, one could change back to a second suit, and daily baths were recommended.

STATISTICS.

Admissions from the railway cars	284
,, ,, Fuchiatien (Chinese town) ...	795

It may be noted that the proportion of plague cases sent from the railway area and from the Chinese town was about 3 to 8. All the patients admitted were Chinese. The railway area is cleaner, better planned and there is not nearly so much crowding.

In the whole of Harbin, only 8 Russians died of pneumonic plague. The one and only bubonic case occurred in a young Russian woman who made a good recovery.

Total admissions into hospital	1421
Number of plague deaths	1312
Non-plague deaths	22
Set free	127

Duration of stay of plague patients in hospital.

	No. of patients recorded.	*Average stay. in days.*	*Longest stay.*	*Average duration.*
Feb.	85	2.8		
March	476	1.7	9 days	1.8 days
April	561	1.7		
May	6	2.1		

Some patients were so ill that they died almost immediately after admission, while others stayed for a few days. It is to be remarked that the average stay was 1.8 days. Though 1312 plague cases were admitted during the four months, the largest number of plague cases in the hospital for one day was 50, because they died so soon after admission. In passing, one may state that the plague cases died most often at night or very early in the morning.

Occupation.			1139 coolies recorded.
Age.	1—10	21	1252 recorded.
	11—20	83	
	21—30	593	
	31—30	385	
	41—50	130	
	51—60	33	
	61—70	6	
	71—80	1	
Sex.	Male	1243	1310 recorded.
	Females	67	

The fact that out of the 1312 plague cases, 1139 belonged to the very poor class is noteworthy. The rest were made up of the small merchant class. Pneumonic plague is a disease which is most dangerous among poor people who live from hand to mouth and who live in crowded small rooms. Large numbers of coolies migrate from Shantung and Chihli to Manchuria, leaving their women-folk behind. These poor people come to make money to support their families at home and many live in crowded inns, or small rooms where the "kang" system exists. Sometimes, in order to economise space, tiers of shelf-like bunks are erected for sleeping purposes. Under these circumstances, it is not to be wondered that such an infectious disease as pneumonic plague can play great havoc among the dwellers especially when the lack of ventilation owing to the rigorous climate is taken into consideration. These factors will explain why so many young and healthy males were killed off, as 593 died between the ages 21—30, and 1243 males died as against 67 females.

Mention may be made of a woman who was pregnant and at full term when she was infected with plague. A few hours before death, she aborted, and the foetus was bacteriologically and microscopically examined. B. pestis was found in the organs, and also in the placenta.

MISCELLANEOUS.

After a little time, one was able to recognise plague cases at sight. The typical patient is apathetic, never actively delirious or maniacal. Depending on the stage of the disease, he cannot respond to one's questions nor what he is told, and many of them are stolid almost to the point of stoical. At this point, one would like to emphasize the remarkable fortitude of the Chinese labourer. He is the best patient in the world and is a staunch fatalist. He will suffer and say nothing. He sees his comrades die and utters not a murmur, fully knowing that he himself would soon share the same fate. Moreover, he is very grateful and appreciates what little one can do for him. He is polite and obliging under all circumstances. In all these respects, he is entitled to one's admiration and deep respect.

The plague patient is somewhat cyanosed and short of breath. His conjunctiva is injected. He coughs and often spits up bright blood. He sometimes complains of pain in the chest, and when he walks, he staggers from side to side like a drunken man. On auscultation there are often no physical signs. When a patient has fever of 102° or 103° F. and a running feeble pulse of 120, together with these signs and symptoms, one has a strong *prima facie* case of plague.

With regard to treatment, nothing was of avail. Two early cases were treated with antiplague serum in large doses both intravenously and hypodermically. Four early cases were injected with neoarsenobillon in 0.9 doses. Intravenous injections of eusol, electrargol, formalin, sodium gynocardate, and acid carbolic *per os* were all tried and failed.

Professor W. J. Simpson related how the laymen of all ranks tended to oppose antiplague measures strenuously. This is not to be wondered at when one realizes how much one is inconvenienced and hampered by any measures taken against epidemics. In India, people have been so worked up that they attacked doctors and sanitary attendants while on duty.

Dr. Wu Lien Teh who had charge of the whole campaign in Manchuria received many threatening and abusive letters. Our doctors, dressers, and attendants also encountered unruly soldiers. Local merchants looked at our work with askance and suspicion. The man in the street spread evil rumours that we shot the patients in our compound and that we poisoned the wells of the town. With all this opposition, hindrance from all quarters, disappointments and difficulties always inseparable from work of this nature, the *morale* of the whole staff was consistently good.

When the epidemic of plague was first reported in Hailar, it was noticed that the first few cases belonged purely to the bubonic type. Afterwards purely septicaemic or mixed septicaemic and pneumonic cases were discovered. Even as late as the third month of the epidemic in Hailar, one purely septicaemic case was found. This may account for the comparatively small number (54) of deaths, owing to the conceivably low infectivity of the septicaemic type.

Towards the end of the epidemic in Harbin, it was noticed in post mortem examinations that the septicaemic type prevailed, so that in the last few cases there was very little tracheitis and very little or no pneumonia at all. This is important because some light is thrown on the cause of the decline of the epidemic. In Manchouli also, the last case reported was of the bubonic type.

Some research work was done among the contacts, and it was found that two men were plague carriers. From their throats, B. pestis was cultivated and Koch's postulates were all fulfilled.

Experiments on the action of different antiseptics on plague sputum showed some interesting facts. It was found that methylated spirit or absolute alcohol killed the B. pestis in 3 minutes. When the sputum was mixed with lime and left alone for 30 minutes, no growth could be obtained, while perchloride of mercury 1/500 did not kill the B. pestis in the sputum after 10 minutes!

Thirty specimens of urine were examined, the results being put down in a tabular form. Twenty-three specimens were voided by plague patients who were ill for 1 or 2 days, the remaining seven were obtained by catheterizing the corpses.

Speaking generally the colour of the urine was dark, the specific gravity was high, and out of these thirty specimens. twenty-eight showed a moderate amount or merely a trace of albumen which was tested by boiling and addition of dilute acetic acid.

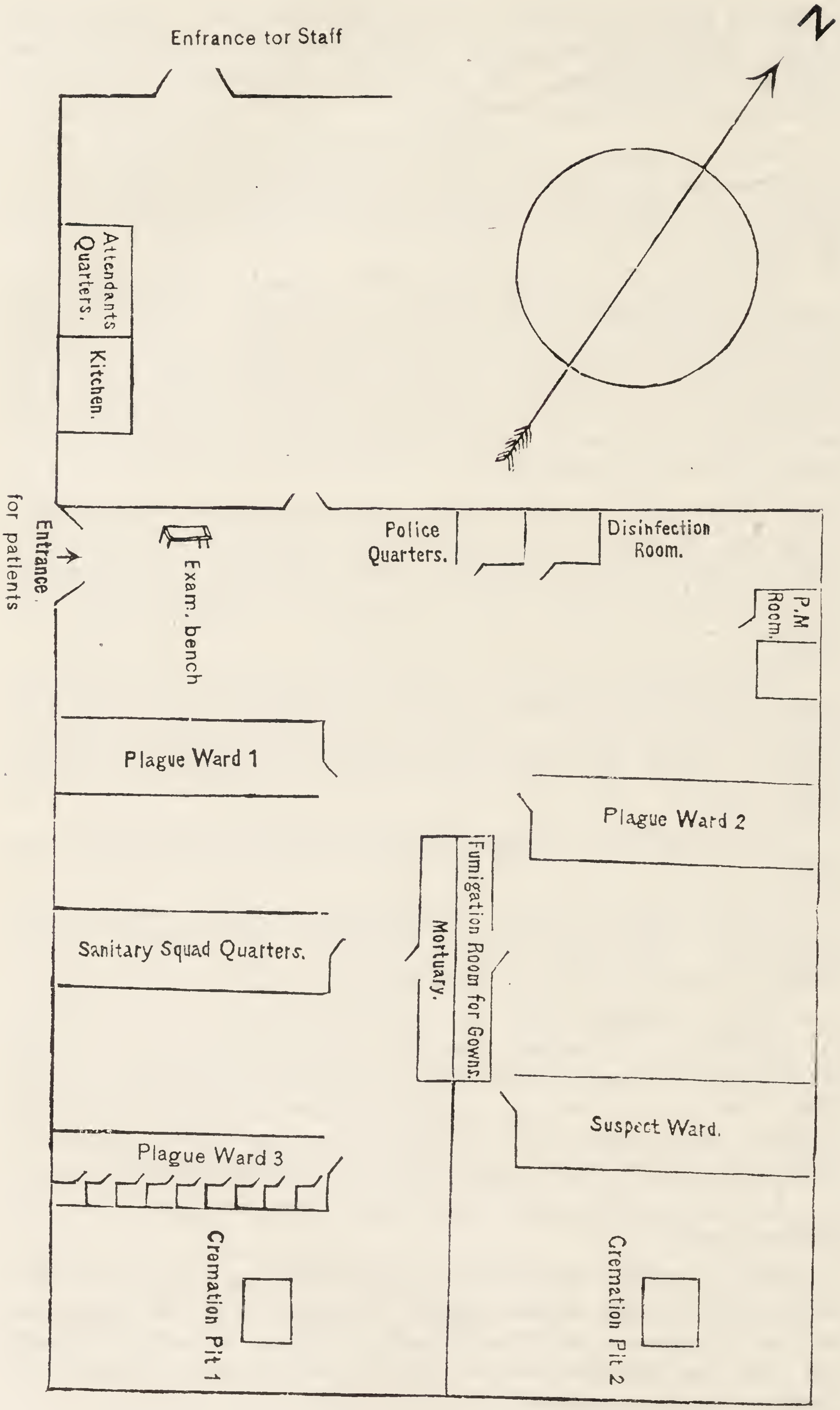
In the majority of cases, hyaline granular casts were present.

With regard to the bacteriology, in only one case B. pestis was cultivated from the urine, and that was when catherization was performed after death.

It was thought that it would be interesting to estimate the amount of chlorides present in the urine, as it is well known that they are diminished in pneumonia as well as some other fevers, so a rough clinical method with silver nitrate solution was employed. In only three specimens, the chlorides appeared to be normal, all the rest showed a diminution.

In this work great assistance was rendered by the bacteriologist.

Many other interesting experiments and data together with notes on the whole plague situation will be published by the Director and Chief Medical Officer to whom thanks are due for permission to make public these meagre and sketchy "salient points."


N
Enfrance tor Staff
Attendants Quarters.
Kitchen.
Entrance for patients
Exam. bench
Police Quarters.
Disinfection Room.
P.M Room.
Plague Ward 1
Plague Ward 2
Sanitary Squad Quarters.
Mortuary.
Fumigation Room for Gowns.
Suspect Ward.
Plague Ward 3
Cremation Pit 1
Cremation Pit 2

SEXES OF PLAGUE PATIENTS. 男女染疫死亡數據各處報告

(From records available)

	Male 男	Percentage 百分率	Female 女	Percentage 百分率	Total 總數
Harbin 哈爾濱	1243	94.2	67	5.1	1310
Manchouli 滿洲里	780	97.9	17	2.1	797
Dalainor 札蘭諾爾	782	99.7	2	0.3	784
Tsitsihar 齊齊哈爾	1390	80.4	338	19.6	1728
Changchun 長春	101	87.0	15	13.0	116
Yu Shu 榆樹	86	56.2	67	53.8	153
Shwangcheng 雙城	129	90.2	14	9.8	143
Asheho 阿什河	86	94.6	5	5.5	91

URINE EXAMINATION OF PLAGUE PATIENTS

Harbin 1921.

Number	Day of Disease	Appearance	Specific Gravity	Reaction	Albumen	Sugar	Deposit	Bacteriology	Chlorides
1	2nd	Orange Slight cloud	1025	Feebly acid	+			—ve	less
2	″	″	1026	″	+ after acetic			—ve	,,
3	″	″	1027	″	+		Hyaline cast Epithelium cells	Sterile	,,
4	″	″	1029	″	Trace after acetic	no	Granular casts	″	,,
5	″	″	1027	″	+ after acetic	,,	Hyaline casts	″	,,
6	″	Pale Orange	1020	″	+ after acetic	,,	Epithelium	—ve	,,
7	Catheter after death	Deep Orange	1025	″	Trace	,,	Hyaline c. leucocytes	+ve	,,
8	2nd	Dark Red	1030	″	+ + after acetic	,,	Granular c. leucocytes Blood Red cells	—ve	Much
9	c. a. d.	Orange	1020	″	+ +	,,	Spermatozoa ? prostate cells	Sterile	less
10	c. a. d.	Light Orange	1030	″	Trace	,,	Granular casts +	—ve	,,
11	1st	″ ″	1030	″	″	,,	Amorphous deposit	Sterile	,,
12	c. a. d.	Yellow	1025	″	+	,,	Epithelium	,,	Much
13	2nd	Orange	1026	″	+	,,	Hyaline & Granular casts	—ve	less
14	″	Yellow Orange	1025	″	+	,,	Granular Hyaline Red white corpuscles	—ve	Normal
15	4th	Reddish	1040	″	Trace after acetic	,,	nil	—ve	less
16	2nd	Yellow	1030	″	none	,,	″	—ve	Normal
17	″	Reddish	1030	″	Trace	,,	Granular & Hyaline	—ve	less
18	c. a. d.	Yellow cloudy	1025	″	+	,,	Renal epithelium Few Red & white cells	—ve	,,
19	c. a. d.	Oran e clear	1027	″	+	,,	Hyaline & Granular	—ve	,,
10	2nd	Yellow clear	1024	acid	+ after acetic	,,	Renal epithelium Granular & Hyaline	—ve	,,
11	″	Orange cloudy	1035	″	+ + after acetic	,,	Granular casts	—ve	,,
12	″	Yellow clear	1020	″	+ +	,,	Granular	—ve	,,
13	″	Orange clear	1034	″	Trace after acetic	,,	No casts	—ve	,,
14	″	Yellow clear	1020	″	″	,,	Epithelium	—ve	,,
25	c a. d.	Yellow cloudy	1025	″	+	,,	Granular Hyaline White Corpuscles	—ve	,,
26	2nd	Yellow clear	1025	″	Trace after acetic	,,	Epithelium	—ve	,,
27	1st	″	1020	″	″	,,	no	—ve	,,
28	2nd	Red clear	1036	″	+ after acetic	,,	Hyaline C.	—ve	,,
29	1st	″	1020	″	none	,,	no	—ve	less
30	2nd	Yellow clear	1035	″	Trace after acetic	,,	No Epithelium	—ve	,,

c. a. d. means catheter after death

AGES OF PLAGUE PATIENTS.

肺疫死者年歲

(From records available)

Age. 歲數	一至十 1-10	十一至二十 11-20	二十一至三十 21-30	三十一至四十 31-40	四十一至五十 41 50	五十一至六十 51-60	六十一至七十 61-70	七十一至八十 71-80	不能查出者 Unknown	總數 Total
Harbin 哈爾濱	21	83	593	385	130	33	6	1	60	1311
Manchouli 滿洲里	1	13	40	50	33	5	3	1	661	797
Dalainor 札蘭諾爾	1	9	152	192	56	9	0	0	365	784
Asheho 阿什河	1	7	13	26	16	18	7	0	...	90
Tsitsihar 齊齊哈爾	94	151	927	381	131	32	12	0	...	1728
Yu Shu 榆樹	26	22	30	22	24	19	10	0	...	153
Shwangcheng 雙城	4	12	83	23	10	9	0	0	...	143

OCCUPATIONS OF PLAGUE PATIENTS.
染疫死者之職業表

(From records available.)

	Harbin 哈爾濱	Manchouli 滿洲里	Dalainor 札蘭諾爾
Police 警察	10		5
Merchant 商人	29		
Tailor 成衣匠	2		
Carpenter 木匠	6		
Prisoner 囚犯	5		
Messenger 差人	1		
Prostitute 妓女	4		
Coolie 苦力	1139	750	
Sanitary squad 衞生隊	5	1	4
Soldier 陸軍	1	2	
Police sergeant 警長	1	1	
Barber 理髮匠	3		
Dyer 染匠	1		
Farmer 農人	1		
Miner 礦工			636
Sanitary Police 衞生警			1
Railway Police 路警		1	
Russian male dresser 俄男助手		2	
Russian female ,, 俄女助手		1	
,, sanitary squad 俄衞生兵		14	
,, sanitary Police 俄衞生警		1	
Doctor 醫士	2		
No occupation 無業	102	20	138
Total 總計	1312	797	784

HARBIN DISTRICT MORTALITY.
哈埠死亡人數

		Hospital. 醫院	*City.* 傅家甸	*Railway.* 鐵路區域	*Total.* 總數	
Jan.	一月	2	0	0	2	(first case 22 Jan.)
Feb.	二月	98	110	47	255	
March	三月	597	480	396	1,483	
April	四月	609	426	296	1,331	
May	五月	6	55	3	64	(last case 24 May)
		1,312	1,071	742	3,125	

ADMISSIONS INTO HARBIN PLAGUE HOSPITAL.
入疫病院之總數

		From Railway Area. 自鐵路區域	*From Fuchiatien.* 自傅家甸	*From Wagons.* 自火車	*From Elsewhere.* 自他方	*Total* 總數	*Plague Deaths.* 疫死
Jan.	一月	0	2	0	0	2	2
Feb.	二月	22	57	47	0	126	98
March	三月	120	367	118	37	642	597
April	四月	133	356	57	117	663	609
May	五月	9	13	5	1	28	6
		284	795	227	155	1,461	1,312

NO. OF PLAGUE DEATHS OUT OF TOTAL ADMISSIONS TO HARBIN PLAGUE HOSPITAL.
入疫病院疫死之數

		From Railway Area. 自鐵路區域	*From Fuchiatien.* 自傅家甸	*From Wagons.* 自隔離車	*From Elsewhere.* 自他方	*Plague Total.* 總數
Jan.	一月	0	2	0	0	2
Feb.	二月	20	44	34	0	98
March	三月	116	357	92	32	597
April	四月	129	330	47	103	609
May	五月	1	0	5	0	6
		266	733	178	135	1,312

NUMBER OF PATIENTS SENT FROM ISOLATION WAGONS TO HARBIN PLAGUE HOSPITAL.

自隔離車送入疫病院

		No. of contacts in wagons. 隔離車人數	*No. of sick sent.* 因病送入疫院人數	*No. of plague cases diagnosed.* 診斷鼠疫病人數
Jan.	一月	0	0	0
Feb.	二月	547	47	34
March	三月	911	118	92
April	四月	485	57	47
May	五月	78	5	5
		3,021	227	178

THE RECENT CHOLERA EPIDEMIC IN CHINA, 1919.

Reprinted from the National Medical Jl. of China, Vol. V 1919.

A. *Historical.*

In the "*Nei Ching*" (內經), a famous book attributed to the Yellow Emperor of China (黃帝) who lived about 2600 B.C., five main "disturbances" of the human body were described, namely, of the extremities, heart, lungs, head, and alimentary tract. To the last affection the two characters, 霍 亂 (*huo-luan*), were given, and have been handed down to the present day. The real meaning of *huo-luan* is sudden disturbance, which even in those early days, 3,500 years ago, was defined as "a disturbance of the bowels and stomach" (亂於腸胃則爲霍亂).

A later medical book published during the Manchu dynasty, called the "Classification of Epidemic Diseases" (溫病條辯), the symptoms of cholera are described as follows: A summer disease, with sudden onset, producing great thirst unrelieved by water, accompanied by repeated vomiting, much sweating, some fever, shivering with cold extremities, contraction of hands and legs, severe cramps, pain over whole body, especially in the abdomen, weak pulse, and delirium. The above seems to fit in well with our modern classical description of cholera!

The Western word "cholera" is evidently a Greek one meaning "spout" which refers to the violent purging like water ejected from the spout of a kettle. The disease was mentioned by Sanskrit writers as far back as 400 B.C., and was also dealt with by Hippocrates. Over sixty references to cholera were also made between 1503 and 1817, but it was not until the latter year that the first authentic account was published of a terrible epidemic, which, first arising in Lower Bengal (the home of cholera, according to Rogers) swept over the whole of India, lasted for five years, and claimed some million inhabitants. From that date onwards, there has been a succession of epidemics of cholera in India, ever extending its boundaries, now to Europe, now to China and Japan, later to America, and lastly Russia, where the disease has established a firm hold.

So far as China is concerned, it may be said that the last great epidemic took place in 1902, as part of the pandemic which passed over Arabia, Egypt, Syria, Persia, Singapore, the East Indies, the Philippines, Japan, and Formosa. In 1908, another great pandemic overtook Russia and many parts of Europe, but only a few cases were registered in Shanghai.

Cholera being essentially a water-borne disease, this disease does not play such havoc among the Chinese (who are tea-drinking people) as among inhabitants of Russia, India, Arabia, and similar countries where the drinking of unboiled water is the rule. It may therefore be understood that although outbreaks of cholera are quite common in Japan and the Philippines, China, except under exceptional circumstances, is fairly free.

The great epidemic of last summer, which swept over the whole country and reached Japan, Siam, India, Afghanistan, Russia, Sweden, etc., may be said to have been introduced from the Philippines to Swatow and Foochow. In the latter city, the first cases were reported early in July, the number rapidly increasing, until nearly a thousand cases were supposed to have occurred daily during the height of the epidemic. From there, it travelled northward and southward. So far as our records go, the following are approximately the dates when the first cases appeared in each city:

Foochow	about July	7
Shanghai	,,	15
Yinkow (Newchwang)	,,	22
Mukden	,,	24
Dairen	August	3
Harbin	,,	5
Changchun	,,	15
Kirin	,,	16
Langfang	,,	15
Fengtai	,,	15
Tientsin	,,	20
Peking	,,	20
Sansing	,,	22
Tokyo, Osaka, Moji	,,	28
Seoul (Korea)	,,	29

Outbreaks were reported from many inland cities in Honan, Anhwei, Hupeh, and Hunan in a more or less virulent form. Altogether the number of deaths due to cholera during the summer months could not be less than 300,000, equal perhaps to the toll from influenza last year.

Our notes on the cholera outbreak have been based upon our experiences in Harbin, but as the principal features are somewhat similar in other districts affected they may be taken as fairly representative of the disease as a whole.

The port of entry of the disease last summer, so far as Manchuria is concerned, may be said to have been Newchwang, which reported its first case on July 22. From the beginning it showed the greatest virulence and claimed a large number of victims. Persons incubating the disease or actually suffering the disease escaped to other places, principally by rail, and spread the infection broadcast. As the weather this year was one of the hottest and driest on record, the people consumed all sorts of fruit, particularly melons, and drank unboiled water carelessly. Moreover, the number of flies was unusually great and proved a most important factor in the dissemination of the infection. For it is well known that in the north of China, and especially the newly opened parts of Manchuria, the poorer classes had no proper places reserved for their evacuations. To them, any open spot is good enough, and the germs of cholera are thus conveyed broadcast by the flies feeding on feces. Melons, especially muskmelons, were displayed on the ground covered with contaminated earth, and eaten, skin and all, before they were even washed. Owing to the dryness of the weather, the wells were drier than usual and the water was therefore more easily contaminated. No wonder cholera spread like wildfire and claimed in Harbin alone over 4,500 deaths in just over six weeks.

The part played by the flies was probably a mechanical one, the germs sticking to their legs when they fed on infected stools and being later released on exposed food.

B. *Symptomatology.*

The clinical features of cholera are perhaps familiar to most. The following represents a typical case: After an incubation period lasting from two to three days the patient complains of being unwell, may have slight fever, and suffers from slight diarrhoea and pain in the stomach. This may go on for a few hours or even a day or two. Suddenly, he experiences great pain in the belly, and severe diarrhoea and vomiting follow. The stools may be yellowish at the beginning, but soon become very liquid and assume a lighter and looser character, being sometimes ejected like water from the tap. They may even be blood-stained. The vomiting is continuous, the ejected material consisting at first of food taken, but later of a simple watery fluid with or without bile. The patient complains of great thirst and rapidly becomes exhausted. Severe cramps of the back, leg, and other muscles occur. His features become shrunken, the skin assumes an ashy-gray hue, the eyes are sunk in the orbits, the nose is pinched, the cheeks are hollow, the voice becomes husky, the extremities turn blue, and the skin is shrivelled and covered with a clammy perspiration. The pulse may not be felt, and no urine may be passed at all. The patient may die from auto-intoxication and heart failure, or may pass on to a comatose stage from which he does not recover.

If medical aid is given in time or if the patient shows signs of recovering, a reaction sets in. The blue colour gradually disappears from the face, the skin becomes warmer and pinker. The pulse becomes stronger, and both diarrhoea and vomiting gradually disappear. For some time afterwards the patient remains in a very weak state, requiring careful nursing.

Our studies of the epidemic in Harbin brought to light some interesting features, which may be briefly described here :

C. *Bacteriology.*

When the epidemic at first broke out, we thought it was something like the *Choleraic Diarrhoea* which had been raging in Shanghai, and in which the characteristic vibrio could not be isolated. During a recent visit to Shanghai, one of us learned from Dr. Tyau, in charge of the Pathological Department of St. Luke's Hospital, that he had only succeeded in isolating the cholera bacillus from one case, and even that one culture refused to grow for a second generation. It would seem as if the climate of Shanghai is not favourable to the growth of this organism in artificial media.

In Harbin, however, we had no difficulty in isolating the bacillus, for on ordinary agar plates it could be easily distinguished as bluish-gray colonies and transplanted. In some cases, a pure culture could be obtained straight from the stools without previous plating. Altogether, we examined twenty-one stools, and isolated the cholera bacillus in nineteen, the other two being both cases of bacillary dysentery from which the causative organisms were isolated. The cholera cultures obtained by us were subjected to all necessary tests, such as agglutination (positive up to 1 in 12,000), animal, cholera-red, gelatin, etc., and all responded. The majority of organisms obtained by us seemed to be rather more slender than what is commonly known as the typical bacillus, but their curved appearance, morphological characteristics and their staining and other reactions were unmistakable.

D. *Pathology.*

This will be treated in a later article.

E. *Clinical Features.*

Out of the 13,000 odd cases occurring in Harbin, we admitted into our Plague Prevention Hospital 1,822 males and 149 females. Of these the majority in both males and females were between twenty-one and forty years of age. See table.

Of the deaths, those between twenty-one and forty years also numbered most.

There was relatively a smaller number of deaths among females than among males.

A fine physique was apparently no protection against the disease; in fact, such patients seemed to withstand the effects of the toxin more poorly than thin persons. Some of our worst cases were among those who weighed 180 pounds or more, and these developed uræmia or died suddenly of heart failure. They also seemed to suffer more from the after effects of saline infusion. An interesting exception was the case of a tall Customs boatman, who got cured after four critical days. See illustrative cases.

The epidemic claimed victims from all classes of people. The only way of catching it was to eat infected food or drink infected water. Some of the prominent merchants died, and two of the members of the Anti-Cholera Committee were missing on the second day of the meeting because they had died of the disease in the interval. The former Taoyin of Taheiho (Chang Shou Tseng) nearly died.

Three ladies, who ate raw shrimps *a la Shanghai*, were all attacked by cholera, and one died.

The epidemic showed a marked decline after the onset of rain. Its worst period coincided with the largest number of flies. After the rain, the flies also diminished in number.

The *stools* of cholera have been compared to rice water. This is not strictly correct, as the stools, though white and watery, are clear and transparent, not opaque and cloudy as rice water. A good description of a cholera stool would be one which is almost transparent, or slightly opalescent when seen in a glass vessel, having little or no odor, but a faint meaty smell, and containing white flakes, consisting of mucus, which settle down when left alone. The patient may pass from ten to fifty or more stools in the course of twenty-four hours, leaving him prostrate and absolutely dried up.

The vomit may at first consist of the usual contents of the stomach, then bile-coloured watery or sticky fluid, and later simple sticky fluid quite pale in colour.

Microscopically, the opaque stools are seen to be due to the presençe of fine granules derived from broken-down epithelial cells. The sediment consists principally of mucus and these damaged cells in various stages of granular degeneration.

The *vomiting* is one of the most distressing features of cholera, and the constant and voluminous ejections of a watery fluid, when none has been swallowed, is one of the most pathognomic features of the disease. The repeated call for water and its equally quick rejection add to the strain. It is found that frequent sips of water are more easily retained, and that small doses of tincture of iodine relieve the symptom.

Abdominal pain, often in the epigastric region, is another prominent symptom, and may be due to the cramps of the abdominal muscles or the abdominal contents or both.

The muscular cramps, another pathognomic feature, may be felt from the beginning and continue to the last stages of collapse. They are confined principally to the muscles of the abdomen and extremities and are seldom felt in the face or back. Well-developed persons feel these cramps more, which may be considerably relieved after saline infusions.

The surface *temperature* is much reduced, although *per* rectum the thermometer may mark 99° F. or more. The pulse quickly loses its steadiness and in bad cases is not felt at all.

The *blood pressure* is often below 70 mm. and sometimes not registrable.

Hiccup is troublesome, but not necessarily a bad omen. In two cases of strongly built men, ending fatally, we observed marked bellowing, like the lion's roar, for ten hours before they died. Both appeared unconscious of their surroundings.

Suppression of the urine follows the fall in blood pressure and is a serious feature of the disease. If unrelieved, this soon ends in uræmia and finally death of the individual. The toxin of cholera apparently has a disastrous effect on the kidneys, which condition is aggravated by the continuous evacuations, vomiting, and consequent increased density of the blood.

Albumin was found in at least half of the cases examined (44) ; some in small, others in large quantities. Not all the albumin cases died, however, and at least half of the cases showing no albumin in the urine died. See table.

Owing to the desire of a large number of patients to return home within twelve to twenty-four hours after injection it was somewhat difficult for us to observe accurately the stages of collapse and reaction among them, but among those who remained in the hospital we found that the longer the collapse stage lasted the greater was the danger of complications arising, especially uræmia. To these we repeated the infusions and also performed proctoclysis (injection of salines by rectum) wherever possible.

We also noted several cases of typhoid-like febrile reactions.

The voice gradually loses its strength and may be lost entirely.

F. *Diagnosis.*

The bedside symptoms of cholera are sudden vomiting and violent purging of white liquid mucous stools, muscular cramps, pain of abdomen, loss of voice, and complete collapse of patient. In a well-established epidemic there ought to be no difficulty in diagnosing the disease, but in case of doubt, especially at the beginning of an epidemic, the bacteriological diagnosis should always be made. Microscopical examination of the stools is not sufficient; plating should always be made and suspected colonies cultured. Cholera colonies are white, semi-transparent, bluishgray in colour. Stained films of the organisms show the characteristic comma-shaped bacilli, while those grown in peptone water display marked motility, in hanging-drop preparations.

During the last epidemic in Harbin, we encountered a large number of cases stimulating cholera, such as the following:

(a) *Dysentery.* Both amœbic and bacillary. One Japanese boy of ten years old was admitted with diarrhoea, vomiting, and collapse. Cultivations from his stools showed only *Dysentery bacilli.* Infusions of saline were also given besides the usual drugs for dysentery, but he died six days after admission.

(b) *Typhoid.* Of this we had four cases at the beginning of the epidemic. Later on, when cholera was on the wane, the number of typhoid cases increased, as the hot season and large number of flies seemed to favour the propagation of typhoid and dysentery as well as cholera.

(c) *Simple Enteritis.* Several cases of simple enteritis were seen at the hospital, but these returned to their homes after being assured that their disease was not the dreaded cholera.

(d) *Tubercular Enteritis.* Two cases of this disease were seen, one a man of thirty-one with marked pulmonary complications.

(e) *Morphinism.* We encountered over ten cases of morphine *habituées* who, during the epidemic, found themselves deprived of their drug and their hiding places. Profuse diarrhoea set in, and some gave a history (perhaps false) of abdominal pain and cramps. In three cases, actual cholera symptoms were noticed.

(f) *Typhus.* Six cases of typhus were admitted during the epidemic with no deaths.

(g) *Pneumonia.* One case of marked lobular pneumonia in a fat, well-built shopkeeper was admitted, because there was no other place for the poor man to go to. He died twenty-four hours after admission.

It may seem strange that such varied cases as the above were admitted into a cholera hospital during an epidemic. Harbin is, however, full of crowded inns and shops, and during an epidemic, when hundreds of persons were taken ill daily, the inmates, suffering from fever, abdominal pain, diarrhea, or any ailment like cholera, were turned out, and the only place where they could find admittance was our hospital. It was fortunate that at no time, even during our busiest times, did we have to refuse admission to urgent cases of any character.

G. *Treatment.*

Details of treatment as adopted by us during the epidemic, as well as the general management, will be treated in a separate article, but we may mention here that besides giving solutions of permanganate of potassium by mouth to oxidize the contents of the stomach and iodine tincture to allay the vomiting, we employed Roger's method of saline infusion on an extensive scale. This solution is made up as follows:

Sodium Chloride	120 grains	(8 grams)
Calcium ,,	4 ,,	(0.25 ,,)
Potassium ,,	6 ,,	(0.40 ,,)
Distilled water	1 pint	(568 c.c.)

The results were very favorable.

Two to three liters of this solution were infused into the brachial veins through a salvarsan needle by the siphon method (two glass tubes fixed through a rubber cork into a large five-pound bottle) or even by means of a large-caliber needle attached to the rubber tubing of a glass enema apparatus. This infusion was repeated whenever necessary; in some cases we repeated the operation four times before the patient was finally relieved.

TABLES OF STATISTICS APPENDED TO CHOLERA ARTICLE.

1. Meteorological Readings of August, 1919.
2. Chart Showing Temperature and Mortality Incidence.
3. Age and Sex Incidence of Admissions.
4. Age Incidence of Mortality.
5. Albumin Incidence as shown in Urine Examinations.
6. Hospital Admissions and Mortality in Various Hospitals.
7. Relative Number of Deaths Among Population.

8. Estimated Population in Harbin Area.
9. Statistics of Anti-Plague Hospital.
10. Statistics of New Fuchiatien Hospital.
11. Statistics of Russian Hospitals.

⟨1⟩ Meteorological Readings

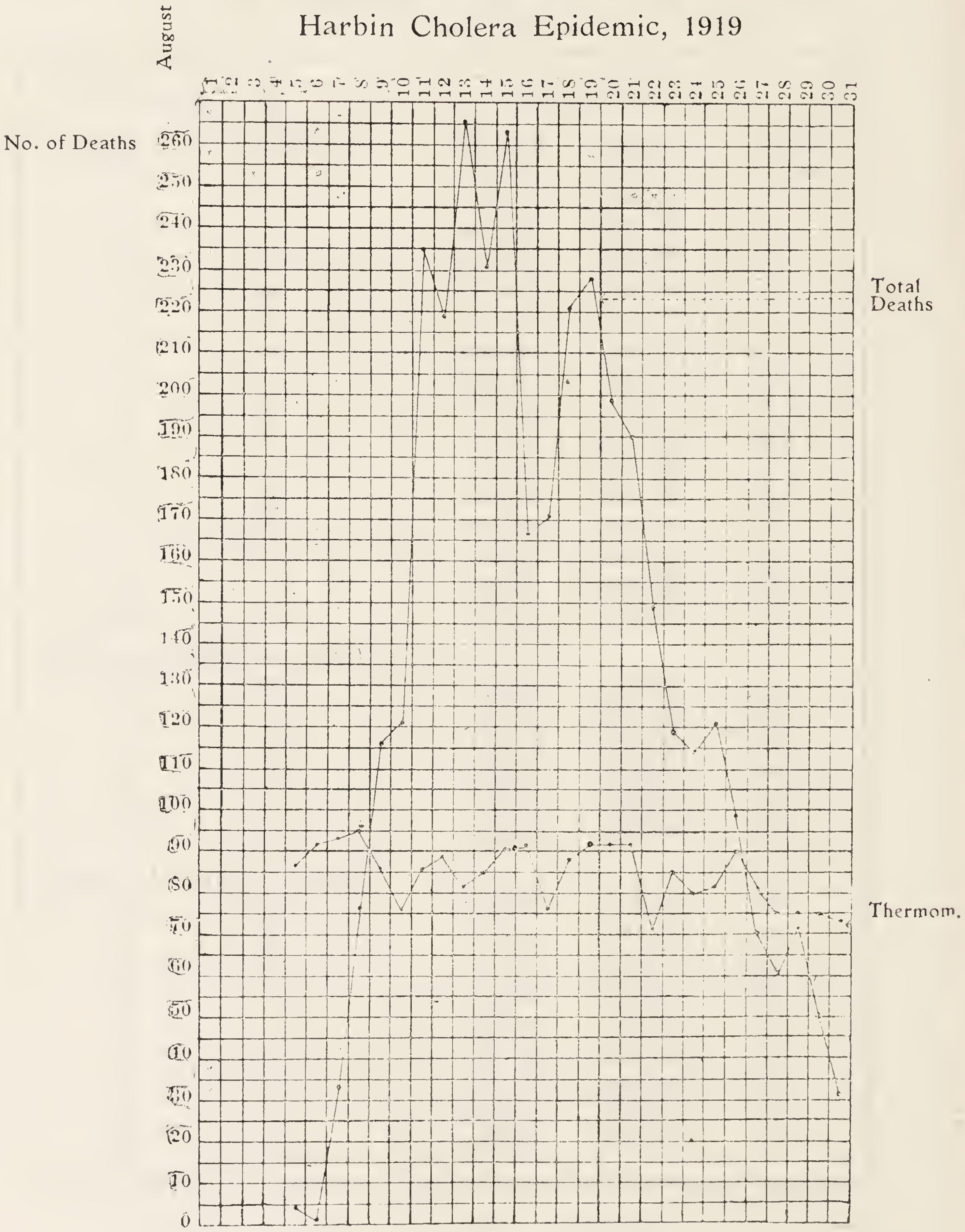
August 1-31, 1919

	BAROMETER		THERMOMETER	
Date	*Highest*	*Lowest*	*Highest*	*Lowest*
Aug. 1.	26.552	29.466	85	61
2.	29.490	29.372	81	67
3.	29.395	29.296	84	64
4.	29.353	26.328	88	66
5.	29.497	29.417	87	68
6.	29.537	29.431	93	68
7.	29.501	29.466	94	69
8.	29.558	29.436	95	73
9.	29.502	29.464	86	74
10.	29.534	29.488	77	66
11.	29.357	29.494	86	64
12.	29 532	29.462	88	60
13.	29.601	29.437	83	71
14.	29.606	29.467	85	61
15.	29.460	29.353	91	61
16.	29.350	29.257	92	69
		rainfall for 24 hours without stopping		
17.	29.352	29.302	78	58
18.	29.485	29.362	88	55
19.	29.550	29.497	93	64
20.	29.642	29.605	93	65
21.	29.622	29.522	93	64
22,	29.538	29.350	73	67
			heavy rain for 36 hours	
23.	29.462	29.420	85	65
24.	29.470	29,390	80	72
25.	29.522	29.474	82	63
26.	29.524	29.416	90	65
27.	29.503	29.432	81	57
28.	29.496	29.380	75	56
29.	29.394	29.366	75	54
30.	29.432	29.263	75	54
31.	29.455	29.335	74	53

Barometer Readings:	Highest 29.642 on the 20th at noon. Lowest 29.257 on the 16th at 3 p.m.
Thermometer Readings:	Highest 96 on the 8th. Lowest 53 on the 21st.

⟨2⟩ Temperature and Mortality Incidence

Harbin Cholera Epidemic, 1919



(3) Admissions. Age Incidence

	MALES. 1,822		FEMALES. 149	
	No.	%	*No.*	%
1-10 yrs	49	2.7	11	7.3
11-20	179	9.8	20	13.4
21-30	592	32.5	39	26.2
31-40	581	31.9	36	24.3
41-50	290	15.9	21	14.2
51-60	116	6.3	18	12.0
61-70	13	0.7	4	2.6
71-80	2	0.02	0	0.0
81-90	0		0	
Total	1,822	100.0	149	100.0

(4) Mortality. Age Incidence

	CHINESE CITY		ANTI-PLAGUE HOSP.	
	No	%	*No.*	%
1-10 yrs	20	1.3	1	0.4
11-20	134	8.8	9	3.5
21-30	345	22.6	90	34.7
31-40	454	29.8	78	30.1
41-50	333	21.8	63	24.3
51-60	176	11.6	12	4.6
61-70	53	3.5	4	1.5
71-80	8	0.5	2	0.8
81-90	2	0.02	0	.00
Total	1,525	99.9	259	99 9

(5) Urine Examinations for Albumin

	Cases Exd.	*No Albumin*	*Trace Albumin*	*Much Albumin*	*Death*
Series I (Before September 1 when epidemic was at its height)	33	13	6	14	6
Series II (After September 1 when epidemic had much abated)	11	5	5	1	2

Of the deaths recorded above, the urine examination results are:

Series I	6	3	1	2
Series II	2	1	0	1

(6) Hospital Admissions (Cholera Epidemic, 1919)

Hospital	*Admissions*	*Deaths*	*% Mortality*
Russian Central	400	135	33.75
Russian Municipal	180	104	57.77
Chinese Anti-Plague	1,962	275	14.11
New Chinese	185	33	17.89

(7) Relative Number of Deaths in Whole Harbin Area

Nationality	*Location*		*No. of Deaths*
Russian	Railway Area		705
Japanese	Railway and Chinese Areas		60
Chinese	Pristan	507	
	New Town	115	
	Chinese city	2,997	
	Anti-plague R.	273	
	New Chinese H.	35	
	Railway wagons	6	3,738
		Total	4.503

(8) Estimated Population of whole Harbin Area (Chinese and Russian cities included)

Russians	35,000
Chinese	95,000
Japanese	3,000
Other nationalities	2,000
Total	135,000

(9) Plague Prevention Hospital (*August 5 to September 10*)

Date	*Admitted*	*Deaths*	*Discharged*	*Under Treatment*
Aug. 5.	1	0	0	1
6.	0	0	0	1
7.	1	0	0	2
8.	2	2	0	4
Aug.	—	—	—	—
9.	8	3	5	4
10.	9	2	3	8
11.	29	7	12	18
12	57	6	26	43
13.	69	4	34	74
14.	92	9	45	112
15.	107	11	81	127
16.	58	9	57	119
17.	117	10	87	139
18.	133	21	90	161
19.	124	28	120	137
20.	123	19	112	129
21.	112	19	105	117
22.	99	17	90	109
23.	137	15	104	127
24.	132	15	98	146
25.	77	22	73	128
26.	85	11	89	113
27.	66	9	84	86
28.	55	10	61	70
29.	65	11	53	71
30.	31	3	54	45
31.	32	2	28	47
Sept. 1.	32	8	46	30
2.	26	1	19	36
3.	19	4	25	26
4.	13	0	13	26
5.	16	1	21	20
6.	9	2	8	19
7.	9	1	13	14
8.	6	1	5	14
9.	6	0	8	12
10.	5	0	1	16
	1,958	275	1,670	2,343

(10) **New Fuchiatien Hospital** ⟨*August 25 to September 13*⟩

Date	*Anmitted*	*Deaths*	*Discharged*	*Under Treatment*
Aug. 25.	9	0	1	8
56.	8	4	1	11
27.	7	1	4	13
28.	25	1	14	23
29.	23	10	21	15
30.	8	4	6	13
31.	9	2	8	12
Sept. 1.	6	3	1	14
2.	16	2	15	13
8.	13	1	11	14
4.	9	1	12	10
5.	13	1	11	11
6.	5	1	6	9
7.	6	0	6	9
8.	7	0	6	10
9.	5	2	5	8
10.	5	0	8	5
11.	5	0	6	4
12.	6	0	10	0
	183	33	152	202

(11) Cholera Report of (a) Russian Central Hospital

Date	*Admitted*	*Deaths*	*Discharged*	*Remaining*
1919 Aug. 10.	12	1	0	11
11.	5	1	2	13
12.	5	2	3	13
13.	17	10	2	18
14.	12	4	4	22
15.	12	4	4	26
16.	15	5	1	35
17.	12	7	3	37
18.	10	7	1	39
19.	16	2	2	51
20.	17	4	3	51
21.	19	18	3	59
22.	17	2	3	71
23.	17	2	4	82
24.	10	0	0	92
25.	34	3	11	112
26.	26	7	1	130
27.	25	7	5	143
28.	13	2	7	147
29.	19	7	13	146
30.	12	7	9	142
31.	9	1	5	145
Sept. 1.	13	9	6	143
2.	6	2	14	133
3.	5	5	15	117
4.	10	6	16	109
5.	3	0	17	100
6.	7	0	18	97
7.	11	1	9	98
8.	1	3	7	89
9.	2	1	11	79
10	2	1	4	76
11.	1	1	8	68
12.	1	0	0	69
13.	1	1	0	69
14.	2	0	0	71
15.	1	0	0	72
16.	0	2	5	65
Mortality % 33.75.	400	135	208	

(b) Russian Municipal Hospital

No individual tables are here obtainable, but it was acknowledged by the medical authorities that the totals were as follows :

Up to September 10	Admissions	180
	Deaths	104
	Discharged	62
	Remaining	13 Mortality % 57.77.

Wu Lien Teh, M.A., M.D. (Camb).
and J.W.H. Chun, M.B., B.C. (Camb).

THE MANAGEMENT OF THE 1919 CHOLERA EPIDEMIC IN HARBIN.

(*Paper read at the Joint Med. Conference, Peking, Feb. 1920*)

PREAMBLE.

The gate through which the cholera epidemic entered Manchuria from the south was Newchwang, where the first case was reported on July 22. Within a week several cases had already been located from different cities in South Manchuria, and our first case in Harbin was discovered on the third of August.

The epidemic found us fairly well prepared. The Plague Prevention Hospital in Harbin had ample accommodation for over three hundred patients and laboratories for diagnosis. The local Taoyin was a modern trained man, while the magistrate had coöperated with one of us since plague times. The merchants also had not forgotten the epidemic of 1910-11 and were willing to contribute money and local aid toward the campaign. There were, however, two main obstacles. First, the city had, during the last five years, expanded too fast for the authorities to cope with sanitary needs. The result was that at many place horse dung and refuse had accumulated, enabling an enormous number of flies to breed. Secondly, the summer had been unusually dry and hot, with the result that water was scarce, and watermelons and other uncooked fruit became more popular than ever. Never during the last ten years had such oppressive heat been experienced or such numbers of flies encountered.

On August 3 one of our medical officers was asked to attend a male patient suffering from suspected cholera in the licensed Chinese quarter. This man had, a few days previously, returned from Shanghai and was attacked by cramps and purging. We advised removal to the hospital, but he refused. No saline infusions were given and he died twenty hours after appearance of the first symptoms. On the fifth a draughtsman of the neighbouring Produce Export Co. was admitted into the hospital suffering from typical cholera symptoms. Cultivations were made from the watery stools and showed the cholera vibrio the next day. His was the first case we infused the saline solution into (two pints), and this was repeated the next day and again later on when demanded. Although the patient improved considerably each time after the infusions, and the pain and purging diminished, he could not retain food and finally refused eating altogether. He died eight days after admission.

By this time, the epidemic had become fairly general, and before many days were passed we had to deal not with one but with hundreds of cases daily.

The steps we adopted for the control of the epidemic may be divided into General and Special as follows:

GENERAL MEASURES.

(a) *Educational.* It was necessary to explain to all classes of people the nature of the disease and the need of taking precautions. For this purpose, we printed leaflets and proclamations in English and Chinese and distributed them by the thousand throughout the city and railway areas. The English leaflets were distributed through their respective consuls and administrative heads to members of the various nationalities residing in Harbin, outlining the nature and cause of the disease, its symptoms, methods of propagation, and simple precautions to be adopted. It is satisfactory to mention that with the exception of Japanese and Russians, of whom sixty and seven hundred and five died, respectively, no foreign lives were lost during the whole epidemic in Harbin.

The Chinese leaflets and proclamations issued by us comprised the following:

(1) Cholera—its nature, cause, symptoms, prevention, and treatment, laying special emhpasis on the need of at once coming to the hospital to be infused.
(2) What to do with patients when sick, including their clothing, bedding, stools, conveyances, and living quarters.
(3) Precautions for households, public buildings, inns, eating-houses, and streets. This was necessary in view of the absence of any enforcement of municipal regulations.
(4) Regulations for the preparation of the dead at home and their disposal at the burial ground.
(5) Constant reports of the progress of the disease, showing admissions and mortality, urging the people from the encouraging returns not to delay coming into hospital and get treated.

(6) Handbills distributed among convalescent patients and friends showing the advantages of modern over ancient methods as exemplified in their individual cases.

(b) Inspection of trains arriving at and leaving Harbin (in combination with Russian railway medical officers) and their disinfection when necessary.

(c) Inspection of incoming and outgoing steamers and other river craft, and disinfection when required.

(d) Formation of cholera boards on one side with the Russian railway authorities, and on the other with the local Chinese officials, merchants, and gentry.

(e) Inspection and cleaning of streets, houses, eating shops, inns, horse and animal sheds. In this connection, it may be said that all watermelons found were confiscated, destroyed, and compensation paid for: gauze covers for all eatables were enforced: pits were dug in the compound of horse repositories for the burning of dung and other fly-breeding material: the streets and interior of houses were sprayed with lime by the occupants of their own accord: fly screens were introduced into dwellings, particularly kitchens, in many places for the first time.

(f) Inspection and control of burial ground. This was found necessary because, owing to the rush, the grave diggers had a habit of simply digging to a depth of two feet, laying the coffin down and then covering it lightly with earth, thus often exposing the contents to the mercy of flies. We had to station special constables at the burial grounds, employed our own coolies to dig trenches eight feet deep, thirty feet long and seven feet wide so as to accommodate fifteen to eighteen coffins in one trench. During the height of the epidemic, at least ten of these large trenches were available at one time for the reception of the dead. As the largest number of dead on any single day was two hundred and seven, this measure was just sufficient. Toward the cost of this work, the American Red Cross contributed $1,000.

SPECIAL MEASURES.

In this, as in previous plague epidemics, it was found that the best results were obtained with the willing coöperation of the local officials, merchants, and gentry. For maintaining order and enforcing regulations, the police proved themselves quite efficient, while the general populace was mainly reached through the Chamber of Commerce and various guilds. Besides periodical inspection of sanitary depots, inspection of trains and steamers, attendance at meetings, and supervision of burial grounds, the energies of our medical staff were concentrated upon the organization of hospitals and the treatment of patients admitted.

Besides our permanent anti-plague hospital with accommodation for three hundred persons, the local community raised funds for a temporary mat-shed cholera hospital of eighty beds, while eleven railway wagons were borrowed from the Chinese Eastern Railway for the accommodation of convalescents. These cars were shunted to a neighbouring siding within easy reach of our hospital and the railway area, so that patients from both localities could be admitted. The medical staff and appliances were all supplied by us. The management of these emergency railway hospital cars deserves special mention. Of the eleven cars, the central one was used for housing the staff and storing supplies, while each box car could accomodate eight to ten patients. No beds were used, only dry straw and blankets, as the weather was very warm. To reach the cars, which had no steps, long wooden planks were made. Each car had its own tub for soiled clothes, jar for disinfectant, and refuse box, all numbered to correspond to the number of the wagon. About fifty feet from the cars were erected kitchens, water pumps, lavatories for men and women covered with mattings. Rain and all superfluous water were drained into a six-foot deep pit some distance away, while stools, bandages, soiled straw and other refuse were burned in a dry pit.

The kitchen range was a simple arrangement and could be adopted in times of war with advantage. The necessary holes and structures for the fire and flues were dug in the ground, the iron pans were laid in position while a few iron sheets were turned into chimneys. In this way, a kitchen for one hundred or more persons could be made on the spot with ease and celerity (see illustration).

TREATMENT.

Our experience in this epidemic was a happier one than the last plague outbreak in Shansi, 1918. Although at the beginning the masses tended to fight shy of our methods, as the majority still believed in the evil influence of spirits as a cause of epidemic, they commenced to send in their sick as soon as word went round that we opened up veins, let out some blood, and injected vital fluids into the system. The fact was that during the first few days we were short of large bore needles and were obliged to open up the brachial veins to enable us to introduce glass canulas and perform infusions. While dissecting the vein, of course some bleeding took place.

It is strange how firmly fixed in the minds of Chinese is the idea of venesection as a means of succouring the sick in all sorts of diseases. When our needles arrived, thanks to the promptness of Dr. Davis of the American Red Cross who removed them from his Potain sets of which he had fifty at his disposal, we prepared two rooms, each with seven benches, for the infusion operations. The materials required were simple in the extreme:

(a) *Apparatus* consisting of a large five-pound narrow-necked glass bottle fitted with a rubber cork with two holes for two glass tubes arranged as a siphon. The bottle is then inverted. During the infusion, the steady flow of liquid into the vein is indicated by regular bubbles of air passing through the external orifice of the long glass tube. To the shorter glass tube is attached a long rubber tube at the end of which is fixed the large-bore needle. Our assistants and dressers soon found themselves adepts in penetrating the veins. The detached needle is first thrust into the vein through the sterilized skin, and when blood is seen oozing out of the needle showing the lumen is entered, the needle is then connected with the infusion apparatus.

Later on we used the ordinary douche—can instead of the narrow-necked glass bottle, as the sterilized solution could be more quickly poured into it, and there were no glass tubes to break.

(b) Hypertonic solution, made up as follows:

Sodium chloride	gr. 120	(8 grams)
Calcium chloride	gr. 4	(0.25 grams)
Potassium chloride	gr. 6	(0.40 grams)
Distilled water	pint 1	(568 c. c.)

Large quantities of this solution were made, placed in big bottles, and sterilized either in the autoclave or ordinary dressing sterilizer. One of the American engineers in Harbin kindly fitted up a disused locomotive for making distilled water and turned out hundreds of gallons daily for our use.

Our registration clerk had his office in the compound of the Isolation Block. This was rendered necessary because of the large number of patients who streamed in, together with their friends. At one time, we had at least four hundred persons in the compound, each one urging his claims to be admitted first. Special mat-sheds were erected for their

> shelter and also for their evacuations into earthenware pots. Flies, and not sick patients, were the most troublesome, and members of our staff had to wear gauze masks in the daytime to protect their noses and mouths.
>
> For three weeks the hospital was kept open day and night, and infusions were kept up all the time, though as might be expected the work was lighter at nighttime. There were relays every four hours.
>
> The soiled clothes, bedding, etc., were soaked in disinfectant solutions and boiled before being sent to the laundry.

Technique. The technique was simple. One medical officer was deputed to sort out the cases, and separate the true cholera from the non-cholera cases, such as simple enteritis, dysentery, typhoid, tubercular enteritis, morphine habit, etc. A slip of paper was handed to his attendant, and also a cloth label containing his number and name tied round his right wrist to identify him in case of death. After this, he was carried into the infusion room on a stretcher. So long as there was any sign of life present, the infusion treatment was adopted. A large proportion of cases showed absolutely no palpable pulse, and beyond some stertorous breathing might almost be called dead. Yet, as soon as half a pint of the saline had been infused, the pulse could be felt in the wrist, the respirations increased in number and strength, the cheeks assumed a fuller appearance, the eyes opened, and the limbs relaxed. Very frequently during infusion, the vomiting and evacuations continued. In several cases, the stools were green at first, became lighter as the infusions continued, then were ejected in spouts as a jellylike white stuff, and finally turned to a white mucous frothy liquid, almost devoid of smell, from which the cholera vibrio was obtained in pure culture. Some patients who came in practically lifeless insisted upon walking out of the operation room after having received two pints within from one half to three quarter of an hour. Each person required about half an hour to receive two pints. During the infusion, patients often shivered considerably and complained of intense cold although the room temperature was about 85°-90° F. After some experience, we regarded this rigor as a sign of sufficient liquid having been given. The volume of the pulse and the specific gravity of the blood were also taken as indicators.

After the infusion, the patients were removed to their wards, where the amount of urine passed by them was noted. A free action of the kidneys was a good omen, while suppression of the urine was regarded as a grave sign. For the latter condition, proctoclysis (rectal injection of weak saline from a douche can through a glass tube with a small aperture) was resorted to. This means was found to be very satisfactory in many cases and saved many lives. Digitalis and strychnine were given when needed to strength the heart, and injections of morphine were made when the cramps were unbearable. Injections of Ol. Camphorae were given in cases of extreme collapse. For quenching the thirst, boiled water tinted with permanganate of potash was distributed *ad lib.*, while a few drops of tincture of iodine in water with or without bismuth were used for profuse vomiting. For the diarrhea itself, it was found that the infusions repeated the same or the next day were the best remedies. Opium and other depressants were rarely used. We had no experience of the Kaolin treatment but vaccines were injected into a large number of foreign residents.

Many patients preferred to leave the hospital a few hours after the infusions and returned on the next and succeeding days for more infusions or further advice. We tried to keep track of these so as to make our statistics as accurate as possible. The after effects of the infusion were seldom injurious. So far as we could ascertain, the thin or the medium-sized man stood the infection of cholera better than the stout or over-muscular subjects. Four of the latter died within four to five hours after the first infusion, their abdomens being abnormally swollen. As no post-mortem examinations were performed on them, we could not discover the true cause, but it was quite possible that death might be due to overtaxed hearts or even to paralysis of the bowels.

Two cases of erythema were seen but it disappeared in a few days. One interesting case showed ecchymosis over both knees during convalescence, but this was absorbed after a week.

Over five cases (including a woman), developing uræmia and ending fatally, first showed purpuric spots on the chest, abdomen, and extremities before death.

Some of the earlier cases upon whom dissection of the veins was made showed slight sepsis, as the bandages were often removed by the patients, but all these healed later on.

When it is considered that we admitted in six weeks 1,962 cases, most of them seriously ill (the lighter cases stayed with the old-style Chinese doctors), with a mortality of 275, i.e., 14.11%, we had reason to feel satisfied with the line of treatment.

The following statistics obtained from official records are instructive for purposes of comparison:

Dairen ⟨Japanese-managed August 3 to September 30⟩

	Cases	*Cured*	*Died*	*Mortality*
Japanese, male	128	50	59	46.1 %
female	61	33	22	36.0 ,,
Chinese, male .. .	864	190	640	74.0 ,,
female	244	58	165	67.2 ,,
	1,297	381	886	68.3 ,,

Changchun, managed as above (August 15 to September 8)

	Cases	*Died*	*Mortality*
Japanese	23	11	47.8 %
Foreigners...	3	3	100.0 ,,
Chinese	804	556	69.6 ,,
	830	570	68.6 ,,

Vladivostok ⟨Russian-managed, August 28 to September 18⟩

	Cases	*Died*	*Mortality*
Europeans...	85	66	65.8 %
Koreans	105	66	57.1 ,,
Chinese	10	7	70.0 ,,
	200	139	69.5 ,,

Harbin (August 3 to September 16)

Name of Hospital	*Admissions*	*Deaths*	*Mortality*
Russian Municipal	180	104	57.77 %
Russian Central	400	135	33.75 ,,
Japanese Cholera ...	22	10	43.45 ,,
(Afghan Expedition, 1919) ...	1,663	566	35.20 ,,
New Chinese Cholera... ...	165	33	17.88 ,,
Chinese Anti-Plague	1,962	275	14.11 ,,

We introduced the use of hypertonic salines for the treatment of cholera after Roger's style from the beginning, and, as may be seen from the records, the results turned out most satisfactory. At the Russian hospital, infusion was not adopted until the sixteenth of August. During the first ten days when they treated their cholera patients with no infusions, there were seventy-one admissions with seventy deaths. Thanks to the coöperation of the American Red Cross surgeons, infusion was introduced later on and things improved considerably. For, on the twenty-first, the last day of the non-infusion treatment, nine deaths were registered, and on the next day when infusion was started, no deaths were recorded. From thence onward, the number of cured cases steadily increased.

We believe that the infusion of saline into the blood stream produced the following favourable effects:

1. (1) It replaced the large quantity of liquid which had been lost through the purging and vomiting.
2. (2) It increased the tonicity of the heart.
3. (3) It diluted the toxin in the system, produced by the vibrio.
4. (4) It helped to clear away the cholera organisms in the alimentary canal.

Without the much-needed fluid at a most critical time, the heart, quite apart from the toxin present, would have simply stopped beating from sheer exhaustion. Otherwise there could not have been this great disparity in our statistics as compared with those in other hospitals, where a different system of treatment prevailed. Unlike pneumonic plague we laid more emphasis upon the actual sufferer than upon the contacts, fully knowing that with sufficient care the cholera patient stood an excellent chance of being cured. The contacts in this case could look after themselves and avoid the disease by avoiding unboiled water, melons, and infected food.

WU LIEN TEH, M.A., M.D. (CAMB).
J. W. H. CHUN, M.B., B.C. (CAMB).

INFLUENZA, INCLUDING ITS INFECTION AMONG PIGS.

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In spring, 1918, an influenza-like epidemic spread all over the world, the treaty ports of China and all the stations in Manchuria, so that it was prevalent from Canton to the most northern parts of Manchuria and from Shanghai westwards to Szechwan, so far as one knew. The infection was exceedingly widespread, so that in Peking it was reported that when one member of the family was infecteed, all the other members also were attacked, that fifty per cent of the police force was incapacitated and in many newspaper offices they were so short of staff that they had to apologize for the reduced size of the paper. There was reason to believe that a similar condition of affairs occurred in all the other infected towns. The most noteworthy feature was that it was very mild and that those who were attacked recovered in three to four days; further, the mortality was very low.

The condition in Harbin at that time may be briefly described. It was reported that forty per cent of the population in the Chinese town (Fuchiatien) was attacked some time or other during April and May when the epidemic was rampant. In our hospital, two doctors, one student, and five atendants were down with influenza. Schools were closed, all kinds of commercial enterprises were understaffed and handicapped by it. Moreover, the disease was not confined to the Chinese alone, as the Russians also suffered and they called it the "Chinese sickness."

A man would have a sudden spell of chilly and shivering feeling, pain in the head, the back, and limbs. He felt weak, with loss of appetite, constipation, and want of sleep. There might be also sneezing and coughing. On examination he would present all the features of toxaemia, the temperature was raised to the average of 100 to 101, the pulse rate was about 100 per minute. There might be tonsillitis and bronchitis. The important feature was that the attack lasted only three to four days with much resulting weakness. The patients went back to work on about the fifth day, and as has been pointed out, the mortality was very low indeed.

The treatment consisted of rest in bed, light diet, purgation, and, to alleviate the aching, salicylates and antipyrine were given with some benefit.

THE EPIDEMIC IN EUROPE.

At about the same time, May—June, 1918, a similar epidemic swept over England. The origin of this epidemic was said to have been an importation from Spain, hence it was known by some as the "Spanish sickness."

The epidemic seems to be very widespread as an extract from the Manchester Guardian (July 1) can testify: "The epidemic of influenza is now being felt in every part of the London machinery. My impression is that nearly every big business has a loss at present from five to fifteen per cent of its staff from this cause. The Post Office, the teaching profession, journalism, the big stores, and shops have more than that average. Many of the Government departments are several reduced.

"The most remarkable case in London was brought out at the inquest on a little girl, an inmate of a Lambeth convent, who died from this disease. The mother superior said that sixty-two of the children had been attacked, being fifty per cent of the total. Dr. Jewesbury, who gave evidence in the case, mentioned quinine as being to a certain extent a preventative, and the best thing people can take."

BACTERIOLOGY.

Surgeon Gotch and Captain Whittingham published in the British Medical Journal the results of their observations. They claimed that they invariably found a gram-negative micrococcus, indistinguishable from M. catarrhalis in swabbings taken from the nasopharynx of persons attacked by this influenza epidemic. Pfeiffer's influenza bacillus was found in sixty-two per cent of the cases, but only cultured in eight per cent.

Though they found other pathogenic microorganisms such as the streptococci, pneumococci, and Fraenkel's pneumobacillus, they held that the infecting agent of the epidemic was Pfeiffer's influenza bacillus, whether by itself or in combination with the M. catarrhalis.

At a special meeting of the Munich Medical Union (July 9, 1918) the influenza epidemic was discussed, for it has not spared Germany. The general opinion was that Pfeiffer's influenza bacillus was only occasionally recovered from the sputum, organs, and also blood of patients (presumably post-mortem).

Kolle reported from Frankfurt that in all cases he found a grampositive diplococcus either in pure culture or in symbiosis with pneumococci. The diplococcus tended to develope involution forms and to grow in very long chains in the condensation water. The British Medical Journal commented that this finding was interesting in view of the fact that Rosenau of the United States and the British armies in France have found similar results.

Dr. Burnford (British Medical Journal, July 20, 1918) commenting on the epidemic, was doubtful of its nature. He remarked that in view of the fact that no uniform results have been obtained in the investigations undertaken, and also that the term "influenza" is loosely applied, much research would have to be done before its true nature could be revealed. He was certain, however, that it was a specific infectious disease in that there is an incubation period leading up to onset, followed by stages of fastigium, defervescence by crisis. He found the element of overcrowding a great predisposing factor to spread infection. He emphasized on the presence of general lymphadenitis in many cases he saw. The cervical glands in the posterior triangle and above the clavicle became prominent, hard and discrete, and they could be felt up to the angle of the jaw and beneath the deep fascia. The axillary, supracondylar, and inguinal glands might also be involved, but with no suppuration. For this reason he suggested that the epidemic might be glandular fever.

No glands were excised for investigation. In conclusion, one may say the bacteriology of the epidemic is still *sub-judice*.

SYMPTOMS AND SIGNS.

The symptoms may be briefly described. People were taken suddenly ill, often while at work, with headache and boneaches. There was a chilly feeling, tightness of the chest and throat, and a dry cough. On the second day of illness the patient would probably be worse. The temperature was raised; there was constipation; the patient wanted to sleep all the time. Though feeling weak, the appetite was at first good and the tongue but slightly furred. There might be photophobia, catarrh of the conjunctiva, the mouth, and the nasopharynx. The cough might get looser. The attacks were mild and the patient felt better with a fall of temperature on the third day or fifth day, though he was not strong again till a week or ten days had passed after that.

In severe cases, meningeal symptoms supervened with bad lumbosacral pains. In certain cases pneumonia was suspected, but as a rule, bronchiolitis was present. The mortality was two per cent, due to penumonia, bronchopneumonia, heart failure, meningitis, and acute asphyxiating bronchiolitis.

In the aged or the feeble, and in those with chronic lung disease, such as chronic bronchitis or adherent pleura, the risks were noticeably greater.

Germany did not escape, for reports from all sources showed that this disease was widely prevalent. Relapse and fatal attacks of pneumonia were frequent. The clinical picture resembled that in England and was identical with the pandemic in 1889.

It was noticed that persons under thirty years of age were mainly victims to this disease. The fact was attributed to survival immunity in the elder generation.

Certain noteworthy points may be put down:

1. The temperature rises rapidly and reaches its height on the second or third day, usually up to 103°F. As has been mentioned, there were two types of cases, one class where the temperature falls to normal on the third and the other on the fifth day.

   Sixty-six per cent of the cases belonged to the third day type and thirty-four per cent to the fifth day type.
2. The pulse is slow, averaging seventy-six to one hundred and ten per minute and does not increase in rapidity in proportion with the rise of temperature.
3. The urine is scanty, highly colored and contains albumin in ninety per cent of cases, varying from a trace to 0. 5 per 1000 (Esbach).
4. The blood. In total white counts there is a distinct leucopenia at the height of the fever (3,000 to 4,500 per c. mm.) On the third or the fifth day, however, there follows a moderate leucocytosis (14,000 to 18,000 per c. mm.) Daily differential counts show a marked relative neutrophilia during the leucopenia, followed by a slight increase of small lymphocytes when leucocytosis sets in. Blood cultures show no organisms.

IN OCTOBER AND NOVEMBER, 1918.

Reports of similar epidemics have come to hand at the time of writing (November). Perhaps the term pandemic would be more appropriate, for it has achieved world-wide extension. News from Europe, Africa, Malay Peninsula, Japan, America, and all ports of China tell of the ravages of an infectious disease. In Great Britain, it was reported that the influenza epidemic had reached a more dangerous stage owing to the advent of septic pneumonia. News from Norway announced that the epidemic was raging there. There were several hundreds of fresh cases every day in Christiania, when to the end of September there were a hundred thousand cases with two thousand deaths.

The death rate from influenza is said to be 400 per day in Japan.

In Kimberley, South Africa, the mortality is 500 daily, one fifth being of the white population.

Newspaper correspondents from almost all the parts of China, either inland or on the coast, sent words of the presence of this influenza and remarking on its severity and the high mortality.

Some called the disease dengue, others "Five Day Plague" or simply "Plague." All tend to show that the disease is rampant in China.

Coming to Manchuria, a similar state of affairs prevails in the South and the North. The Government hospital in Dairen is overcrowded with those down with influenza. Doctors and nurses have also been infected. According to Dr. Tsurumi (Superintendent of the Isolation Hospital) the influenza epidemic in S. Manchuria victimized about 15,000 Japanese and Chinese between the latter part of last year and last spring. At Fushun, the epidemic claimed 7,000 victims. The result was that the coal output of the collieries was reduced to one quarter of the ordinary returns.

Influenza had its sway in towns situated all round Harbin; thus Hulan, Ashiho, and Shwangcheng were reported to have a daily mortality of twenty to thirty persons in each place; Tsitsihar and Changchun have a mortality of one hundred persons; in fact, it is spreading in all towns either off or on the railway. One hears that the coffin makers do a great business and all the coffins are sold out.

The disease does not seem to have had such a grip on Harbin as yet. However, at least ten to twenty per cent of the population are or have been attacked this autumn. In the Chinese town (Fuchiatien) the death rate has not been noticeably high, when compared with surrounding districts. Among Russians (exclusive of Jews) eighty to ninety persons have died of influenza or its after-effects from October 1 to November 10.

The Chief of Police in Fuchiatien has approached us for a discussion of ways and means to stop the inrush and spread of this widely-distributed disease. As a result, we explained to him the nature of the disease and the necessity of the wide dissemination of knowledge of its mode of spread, its cause, etc., and suggested that we should write a short explanation of the disease with a view of putting it in the newspapers and posting it in the streets.

The worst element to contend with in Fuchiatien is the overcrowding. The rigorous cold and the high cost of living account for the huddling of people together for sleeping accommodation. A room containing eight sleepers is quite usual; while in small inns, men are packed like sardines, sleeping on "kangs."

At the Harbin Hospital, and in private practice several cases have been seen. Six cases had been admitted up to date, of whom two died, both seen at the late stage of the disease (the seventh day): one died of pneumonia and the other of asphyxiating bronchiolitis, both clinically diagnosed, as no post-mortem examinations were allowed.

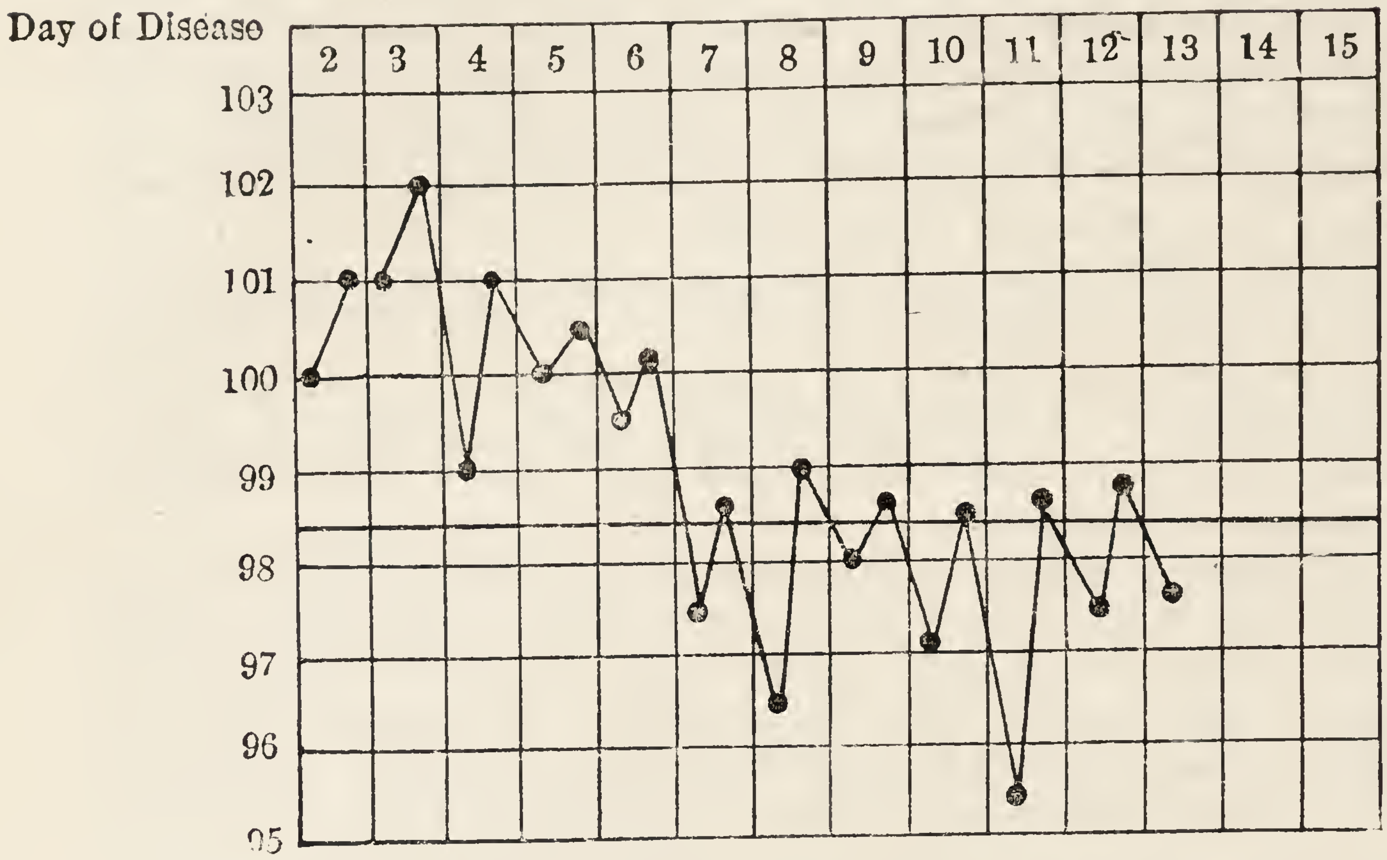
Few cases have been seen among the out-patients, however. First of all, the Chinese people believe in foreign surgery, but not much in foreign medicine; eighty to eighty-five per cent of our admissions are surgical. So when they feel sick, they just lie in bed and wait till they are well or send for a Chinese doctor practicing native medicine. Also when a man has fever, it is thought most deadly to expose him to the open air. The "road" from the town to the hospital is very uneven and rough, and the influenza patient would have to be carried on some form of stretcher, and many cannot afford the expense, or have no friends to help them.

The clinical picture corresponds exactly to that described in England, save that the influenza this autumn seems more severe and has caused many deaths.

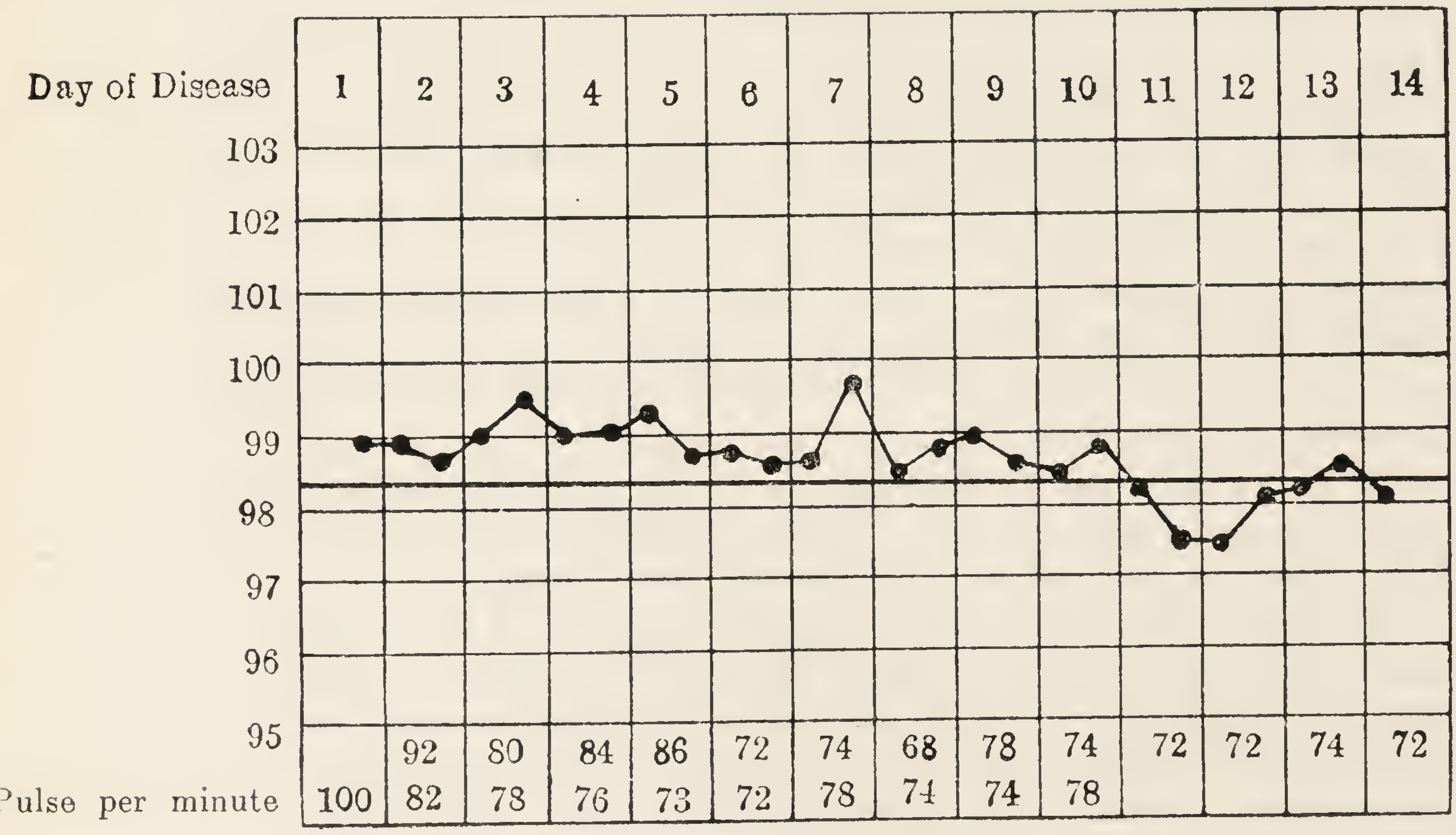
It is interesting to note that though influenza, like scarlet fever, is a comparatively new disease in China, having been introduced from the Occident, the mortality in this epidemic in China does not seem to be heavier than elsewhere, though one would expect it to be so.

It is unnecessary to give a detailed resume of the symptoms and signs of the cases seen in Harbin. Suffice it to put down a few cases to illustrate the disease.

Case 1. Mrs. W., aged 30, seen on second day, sudden onset, first cold then hot, with headache, malaise, constipation, no boneache, no palpable cervical glands, no pharyngitis, no bronchitis. Anorexia present; urine highly colored, no albumin. Pulse was never quicker than 100 a minute. Recovery with fall of temperature. Strength returned five days afterwards.

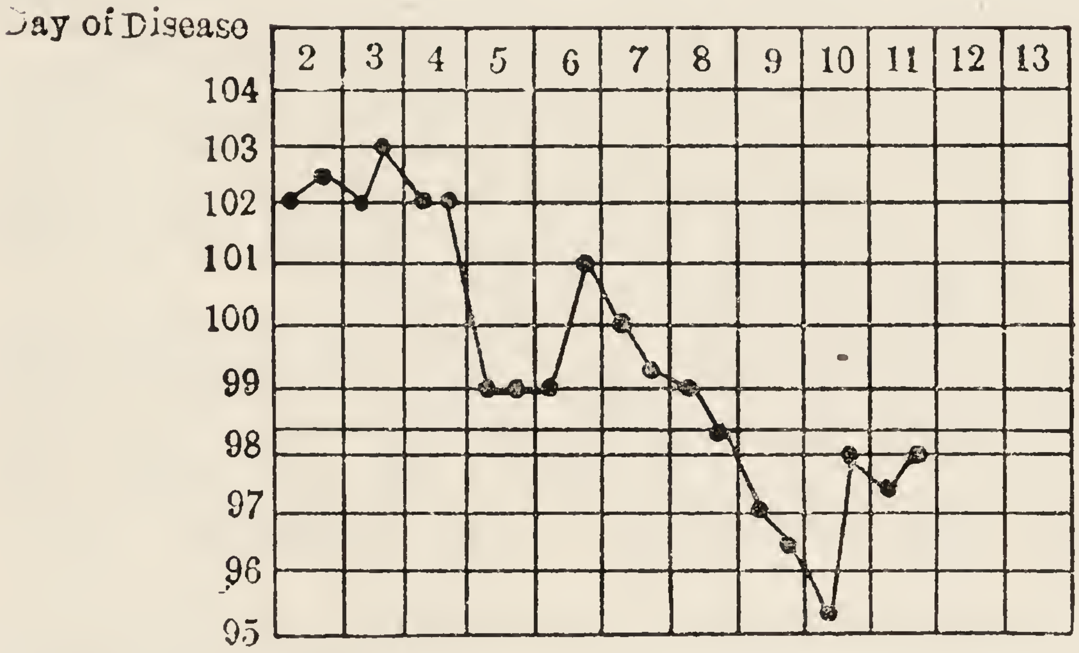


Case II. Mrs. B., aged 28, seen on first day, began by vomiting three to five times, felt shivery with persistent headache (felt as if top of the head were coming off) for four days. Second day fell worse; no nasopharyngeal catarrh, no cervical glands, no cough. Pulse and temperature as in chart. Slept most of the time. Felt weak all the time. Constipation present. Anorexia slight.



Case. III. Mr. W., aged 31, seen on second day of illness, onset sudden, after a motor ride. He felt shivery and no bedclothes could make him warm. Dry cough present, no bronchitis. Felt weak, with severe headache and backache (as if back were broken in two). Temperature fell to normal by lysis on the fifth day and he felt strong again seven days after that.

Case IV. Dr. C., aged 32, became sick after visiting a friend several times who was ill with influenza. This was the third attack in ten years; first in 1908, second in 1911. Felt cold one evening, next morning woke up with malaise and fever. No aches anywhere. Tongue clean and appetite good and remained so for four days. Cough; epistaxis occurred on the third day. Constipation present. Patient was sulky and inclined to sleep. Urine highly colored. Recovery with fall of temperature. He became thinner and paler, but regained strength on the twelfth day after onset.



Case V. Mrs. C., aged 24, woke up one morning with fever, 101° F., headache, malaise, and constipation, but with no anorexia. Became worse on the second day. Temperature 102° F. and pulse 100 per minute. Nasopharyngeal catarrh, and cough were present. On the third day, temperature fell to normal and the patient felt strong again on the fifth day, but a dry cough persisted for two weeks afterwards.

Case VI. Amah, aged 25, infected while attending sick mistress; sudden onset with headache, fever 102° F., malaise, and dry cough. Expression solemn. Recovery in five days with fall of temperature.

Case VII. Soldier, aged 25, onset with chill and then afterwards heat. When seen on the seventh day of illness, he was weak, expression was anxious, and could hardly stand. Sputum was tinged with blood (this is a sign that the case is serious); breathing hurried, lips cyanosed and pulse rapid, 120 perminute. Lungs showed fine ronchi and signs of congestion ast the bases. He died from asphyxiating bronchiolitis on the eighth day. No post-mortem was performed.

INFECTION AMONG-PIGS.

In October, 1918, at the same time that this influenza epidemic was achieving world-wide reputation, there existed an epidemic of some disease among Russian and Chinese pigs all round Harbin. This disease among the pigs has been diagnosed as influenza by Russian veterinary surgeons.

The mortality is very severe, so that one large hog-breeding company lost two hundred pigs in a few days, and a small company lost fifty per cent of their stock.

The disease attacks both fully grown pigs and also young ones, but it is the latter that suffer most.

The pigs first begin to show their sickness by coughing and refusing food. After three to five days they died.

Opportunity for investigation was afforded and swabbings from the throats of thirteen pigs which died of this disease were taken by us. Many bacteria were encountered. In ten, a gram-positive diplococcus was present though not in large numbers. Pfeiffer's bacillus was not seen.

Cultures were taken from the throat and from the blood of two pigs. From the throat growths of staphylococcus, B. pyocyaneus, and a spore-bearing bacillus which was non-pathogenic when injected into a guinea pig, were grown. The blood culture was contaminated, so no information was obtained.

Post-mortem examination was performed on a pig which died of this disease. The lung was non-adherent and there was no fluid in the pleura. Macroscopically the lungs were everywhere congested and miliary patches of grey consolidation could be seen. No large areas of solid lung were detected and the lung floated in water.

Microscopically the lung presented a picture of broncho-pneumonia in that the alveoli were filled with endothelial cells; hyperaemia was present. The bronchioli also showed signs of inflammation.

After staining the section in Giemsa's stain for twenty-four hours and washing with dilute acetic, no microorganisms of any kind were seen under the microscope with the oil-immersion lens.

J. W. H. Chun, M.B., B.C., (Cantab)
(*Senior Medical Officer, Harbin.*)

SOME NOTES ON SKIN GRAFTING.

Reprinted from the National Med Jl. of China, Vol. IV. 1918.

In medical practice among the Chinese, one comes across many cases which present themselves for treatment some time after they have received burns or injuries, and show large, raw, granulating surfaces. If left to themselves, these wounds take a long time to heal, and, if they heal at all, the scars are apt to break down again or to cause keloidal cicatrixation.

For the treatment of these patients, the idea of skin grafting naturally occurs to the mind.

On turning to textbooks, three methods, as a rule, are given.

(1) Reverdin's method. A small piece of skin, 3 to 4 mm. is cut off, usually from the front of the tibia, including the cutis, and some part of the cutis vera placed on the granulation surface to be covered. Many of these grafts may be obtained and the whole covered by a protective.

(2) Thiersch's method. The raw surface is scraped and and all bleeding stopped. A series of strips of skin are cut very thin, by means of a razor, from the inner side of the thigh or arm and applied to the prepared surface. The strips are made to overlap each other and the edge of the defect. Perforated tin or thin silver foil may be used to cover the wound, which should not be disturbed until a few days have elapsed. In this method, however, the adhering of grafts is uncertain, and the resulting scar is liable to break down. Moreover, a general anaesthetic is required.

(3) Wolfe's method. The whole thickness of the skin is cut off rather larger then is necessary to allow for shrinkage, the subcutaneous tissue and fat being afterwards removed. This graft is applied to the raw surface after the granulations were scraped and is stitched into position.

In 1870, Steele, of Bristol, adopted a method of skin grafting similar to Reverdin's but it differed in the fact that the grafts included the whole thickness of skin, excluding fat and areolar tissue, and that they were larger, having the size of a big pea or bigger. The object is that the newly formed skin shall preserve its elasticity under tension, thus resulting in a stronger scar.

Douglas, Colebrook, and Fleming published an important paper (The Lancet, 7th. July, 1917) on their method and results in skin grafting. The authors obtained best results from Steele's grafts and "Section Grafting."

The anaesthetic used. In order to render an area anaesthetic for obtaining Steele's grafts, they block the external cutaneous or anterior crural nerve by a 2% solution of novocain with a small addition of adrenalin (1 in 50,000) so that an area on the outer and lower part of the thigh, or on the outer and anterior aspect, is made anaesthetic. To block the external cutaneous nerve, the needle is introduced a little below and to the inner side of the anterior superior spine; the tissues above and below the deep fascia are now infiltrated, the needle being thrust downwards, inwards, and outwards from the point where it was inserted. About 5 mils novocain solution are used. To block the anterior crural nerve, the needle is inserted at a point midway between the spine of the pubis and the anterior superior spine. 1 cm. below the ligament as the nerve divides at about this point. The nerve usually lies at the depth of 0.5 to 1 cm. below the fascia. For "section grafting" they obtain anaesthesia by infiltration of the area by novocain solution.

The author's method of cutting Steele's grafts. A superficial but firm hold is made on the skin with towel-holding forceps, and a horizontal cut with a scalpel is made so that a piece of skin 6 to 12 mm. in diameter is removed. With the same forceps the graft is transferred to the wound and spread on it with the help of a blunt instrument. After releasing the graft the points of the forceps are dipped into an antiseptic so as to remove any organisms that may be carried to the area from which the grafts are taken. After a sufficient number has been taken, the shallow wounds made are closed with a stitch which is not removed until 10 to 12 days later.

Section grafting. An elliptical strip of skin from 5 to 10 cm. long and 1 cm. broad is dissected off an area of the thigh or arm anaesthetized by infiltration with novocain solution. The strip is then rid of all fat and areolar tissue, and is cut into thin vertical sections with scissors. The sections are placed in Locke's solution and from there removed to the wound. The wound from which the skin was taken must be closed with suture. In this way a small piece of skin can be made to cover a large wound. (Locke's solution contains in a liter of distilled water, sodium bicarbonate, 0.15 g.; calcium chloride, 0.24 g.; potassium chloride, 0.24 g.; sodium chloride, 9.2 g.)

The disposal of the grafts. Special attention was drawn to the fact that a wound gets covered more quickly when the grafts are placed close together. They drew attention to Carrel's work, which showed that (1) the rate of epithelial growth over an almost aseptic surface is inversily proportional to the size of the wound; and (2) when the interval between the epithelial edges is more than 10 to 15 mm. the spread of the epithelial edge is very slow, while the growth becomes quicker and quicker as the edges approach one another. The authors therefore arranged their grafts close together on the wound. When, however, the wound to be covered is large, new grafts may be placed round the edge, and after these have taken in about 12 days' time, more grafts will be required at a second sitting.

The favourable or unfavorable condition of the wound to be covered. The favorable type of wound to graft is one that shows a clean, flat surface, covered with small bright granulations, painless on being touched, and having an active growing epithelial edge. A less favorable type is one on which the granulations are coarser, paler in color, less firm, and tending to bleed. Microscopically if the discharge shows few bacteria, the wound may be considered fit for grafting The impression they obtained was that B. pyocyaneus was more harmful to the young grafts than any other bacteria. To improve the unfavorable type, they applied pressure for a day or two, combined with a lotion of silver nitrate, zinc sulphate, or brilliant green.

After treatment. The authors noted that the presence of long retained pus under the protective used for covering the skin grafts tended to cause the ingestion of them. They had a perforated oiled fabric made for the covering of the grafts, and called this fabric, "perforated parex protective." After the grafts are placed in position they cover the whole with this protective, outside that several layers of button-muslin moist with Locke's solution, and outside that a piece of oil paper and bandage. The wound must be dressed every day after operation. The button-muslin is first of all made damp with a spray of Locke's solution and gently rolled off; the perforated parex protective is not touched, while the spray washes the wound through the perforations. After a week or so, the oiled protective may be removed from the wound for inspection, but it must be replaced on the wound again and is not dispensed with until 2 to 3 days afterwards.

The source of the grafts. The authors devised two terms, "autodermic grafts" and isodermic grafts. "By the former they mean that the grafts are taken from some part of the patient's body for whom the grafts are taken. By the latter they mean that the grafts are taken from some place other than the patient's body; they are obtained from some amputated limb. Where there is a very large area to be covered, they recommended the use of "isodermic grafts." The amputated limb is placed with severed end downwards, and is then stitched up. The selected area is then cleansed with soap and antiseptic, and the Steele's grafts are taken. The limbs in certain instances have been kept for 6 to 13 hours in a moist cloth at room temperature before the grafts were taken. In one case, the grafts were taken 6 hours after operation and then put in Locke's solution overnight. The results from four cases showed that this method is worth doing under certain circumstances, but that the grafts do not take with such certainty as in the autodermic method.

Dr. Wedertake (Munich Med. Wochen, Military Supplement, June 12 1917) advocates the use of fresh hernial sacs for skin grafting. He put the sac on the wound with the epithelial side uppermost, and the resulting scars, he claims, are useful painless, and nonadherent. He painted the raw surface first of all with alum acetate solution several days before grafting, and just before putting the grafts on, he painted the wound with fresh blood serum or applied Bier's congestion to cause a flow of lymph.

Douglas and his co-workers emphasized that new features in their methods are: (1) The use of local anaesthetic induced by nerve blocking. (2) The suture of each of the small wounds left after the removal of the grafts. (3) The use of an oiled perforated protective to hold the grafts in position, to allow the escape of any discharge, and to permit the surface to be cleaned efficiently. (4) The daily change of the outer dressings which are kept moist by a bland fluid.

The advantages claimed for the methods advocated are: (1) Successful results can be obtained much more constantly. (2) The use of the general anaesthetic is dispensed with. (3) The raw surfaces left after the removal of the grafts, being closed with sutures, heal rapidly and certainly. (4) The resulting scars are stronger, more elastic, and less prone to ulceration than those resulting either from Thiersch's grafts or from the natural healing of the wounds.

Their results in 29 cases so treated may be put down as follows:

80% to 100% of the grafts adhered in 18 cases.
48% to 80% ,, ,, ,, ,, ,, 7 ,,
5% to 15% ,, ,, ,, ,, ,, 3 ,,

Four cases of skin grafting after the "section grafting" method were done, two of which were perfect successes, and the remaining two were partial successes.

Encouraged by these papers two cases were treated in the Harbin Hospital, one by autodermic and the other by isodermic grafts. Brief notes may be given.

Case I. Sui, aged 28, was warming himself by a charcoal burner in May, 1917, when he was overcome by carbon monoxide gas, and fell unconscious, and the outer and upper parts of the right thigh came in contact with the fire. When rescued, it was found that the whole of the upper part of the outer aspect of the right thigh was burned. He was admitted into the hospital in July, 1917, when he was seen to have a contracture of the right hip and knee as a result of keeping the limb flexed and a partially healed wound from a burn. The periphery was covered with a thin, newly formed scar. In the middle there was an area of granulation tissue, oval in shape which measured about 5 inches by 3 inches. The granulations were unhealthy, painful to the touch, and bleeding easily. The wound was cleansed with dressings, and in August, 1917, it was skin grafted by Reverdin's method; in all 30 grafts were taken from the patient's left thigh. All the grafts took and started to grow slowly. As soon as there seemed some progress, however, there appeared signs of breaking down of the scar all round the central surface. At last, in October, the wound was dressed with Eusol and exposed to the sun for half an hour daily. It was noticed to improve at once, and during November it steadily grew smaller and smaller, and the healed skin did not break down. There is at present, in December, a small area 1 in. by 1½ in. which has still to be covered.

Case 2. Chang, 17 years of age, carter, had his left arm twisted in the wheel of his cart in June, 1917, resulting in a compound fracture of the elbow. He came to the hospital for treatment in October, when it was found that the left elbow had an annular ring of raw surface all round it extending one and one half inches above and below the joint. The granulations were firm and healthy, there being but little discharge. The elbow joint was ankylosed in the position of right angle. After cleansing the wound with dressings, in the middle of November Steele's grafts were obtained from a leg which had been amputated for tuberculosis of the tarsal bones. In all about 150 grafts were taken from the lower part of the leg, after washing it with lysol soap immediately after the amputation. Due regard to the disposition of the grafts was taken as taught by Douglas and his co-workers, so they were placed close together. About 40% of the grafts took and started to spread. After the grafts were seen to have taken, the wound was daily dressed with Eusol end exposed to the sun for half an hour daily. When seen in December the wound was partially covered with large patches of firm skin. Certain bare areas have still to be covered, and the method of section grafting was practiced on them in the middle of December with the result that 30% of the grafts took. In future it may be necessary to obtain more grafts for the wound.

J. W. H. Chun, M.B., B.C. (*Cantab*).
(*Senior Medical Officer*).

MEMORANDUM ON MEDICAL EDUCATION IN CHINA.

As Submitted to the Ministry of Education, 1914.

I have the honour to submit a Memorandum on the present status of Medical Education in China and on the urgent need of thorough reform in this matter, which I trust Your Excellency will be good enough to consider.

2. As you are aware, I have lately returned from attending on behalf of our Government, the large International Congress of Medicine in London, at which 7,400 physicians and surgeons from all parts of the world were present and also from the International Congress of School Hygiene held at Buffalo where pressing problems regarding child welfare and the adequate supervision of children by school medical officers were discussed.

At these Congresses the leading scientists and educationists of over thirty countries expressed their views and gave practical demonstrations on the most recent methods employed for the benefit of the human race from nursery to old age. At the London Congress upwards of 500 medical men and women came from America and a like number from Germany; Japan, though so far from Europe, sent sixty of her eminent doctors, whilst China was represented by only myself and Professor Chuan of the Peiyang Medical College. The subjects discussed were divided into 26 different sections, and over 1,000 papers were read. These covered a wide field ranging from the most difficult operations on the brain, heart and lungs to the most delicate investigations on micro-organisms, so small as to pass through very fine filters and to be invisible even under the highest powers of the microscope.

The Congress at Buffalo, though more limited in scope, nevertheless showed the great attention which modern civilised nations were giving to the mental and physical development of the future generation. At this Congress were discussed such problems as the construction, equipment and management of school buildings so as to be not only pleasing to the eye but also healthful for children; the prevention and control of infectious diseases; the teaching of simple facts about Hygiene at school; the appointment of school medical officers and their intimate relation with educational authorities; and even the use of discarded men of war as sanatoria and open air schools.

3. It is impossible to be present at these Congresses of learned men and not feel the backwardness of our people in all questions relating to the study of modern scientific methods as applied to industry, medicine, hygiene and sanitation. Whilst people in western countries, by utilising the newest discoveries continually made in science, have succeeded, or are succeeding, in stamping out such dire diseases as small-pox, plague, leprosy, typhus, relapsing fever, malaria, tuberculosis, etc., in our country large numbers of children and adults are still being carried away by these maladies. The introduction of hygienic habits among the people and a proper system of public sanitation and medical inspection have been the main causes in bringing about these happy results; and, along with scientific education and the proper distribution of duties among people trained in their special branches of work, have contributed to the progress, efficiency and high standard of living seen among western nations.

4. It has always been my aim since my return from my studies in England, Germany and France to devote what little skill I possess in alleviating and preventing as far as possible suffering among our people. One of the fundamental necessities for bringing this about is to improve and further the best interests of medical science and education so that the graduates of our medical colleges may have the same standard of efficiency and ideals as those of the west. To attain this desirable object, it is clearly essential that the institutions where medical education is given and the hospitals where the sick are cared for and the students learn their clinical work, should be in the hands of men who themselves have worked in and are thoroughly acquainted with the management of the best medical schools and hospitals of the west. Unless this is done, our present and future institutions will not only fail to reach a high standard but actually degenerate in proportion to the progress made by other countries. This will naturally have a permanent and correspondingly injurious effect on our medical practitioners, into whose hands the lives of millions are entrusted.

5. *Personal Observations.* I deem it expedient to mention here some of the observations I have made during the six years that I have had the honour of serving our Government. I spite of some excellent methods of treatment and a long list of useful drugs handed down to us by the ancients nothing has been done by their successors either to improve that knowledge or to keep abreast of the times. The result is deplorable, and the majority of native trained physicians of to-day are completely ignorant of the true causes of most diseases, especially epidemic diseases, their methods of diagnosis, their causes and modes of prevention. On the other

hand, certain maladies, such as Malarial Fever, internal abscesses, blindness due to cataract of the eye, which owing to insufficient knowledge were regarded by the ancients as incurable, are still regarded by modern native physicians as incurable, whereas they are known by all western trained doctors to yield to simple drugs and operations. Diseases like Typhus, Relapsing Fever, Leprosy, which occur with alarming frequency in China, are now unknown in those countries where clean and healthy habits are adopted, such as regular bathing of the body, changing of inner clothes, and the enjoyment of light and well-aired sleeping apartments. Syphilis is terribly rampant in both hemispheres and the same drug (mercury) is used in its treatment, but the west shows better results because the methods employed are more accurate and scientific. Thanks to unceasing research of late years new means of diagnosis and treatment have been introduced, whereby many of the grave aftereffects of the disease, still observed in China, can be prevented. Another common ailment is Tuberculosis. Up to recent years this disease was as prevalent in the west as in the east, and regarded as transmissible from parent to offspring. After the micro-organism was discovered and studied in 1882, the disease has been proved to be non-hereditary. At the same time the proper measures for its prevention have been enforced, with the result that innumerable lives are now saved yearly. In China, unfortunately, simple measures such as the prohibition of spitting, the importance of working and sleeping in well-ventilated rooms, taking of regular exercise in the open air, separation of the diseased from the healthy, are not known and practised by even the educated classes, hence consumption of the lungs, of glands, of bones, etc., is extremely common. These cases, even when diagnosed, are not properly treated. As a result, large numbers, including some of our most promising young men, are sacrificed to an early grave.

Although inoculation for the prevention of small-pox was first practised in China, and introduced by way of Turkey into Europe, the practice of vaccination against the same disease has been proved to be of much greater benefit to mankind without the dangers incidental to inoculation. Every civilized Government now enforces vaccination amongst its people, and small-pox therefore has almost completely disappeared in those countries. The same cannot be said of China, where thousands of children are either killed outright or become blind and incapacitated for ever. In Peking one out of every three native born women shows old pockmarks. To remedy this our authorities have only to insist upon vaccination of children before the first year, at the same time explaining its benefits and the entire absence of bad results. Our forefathers many generations ago handed down a code of rules relating to simple facts in hygiene, which have enabled us to live through many centuries in comparatively good health. It therefore seems a great pity that whilst other nations have continued to progress and improve their race, we have not taken advantage of the new knowledge available to enable us to do the same.

Pestilences like plague, cholera, dysentery and typhus, still claim numerous victims every year, and the methods adopted to cope with these evils are often of the most primitive nature making us the laughing-stock of the world.

Our graduates owing to insufficient training at home are not recognised by the universities of other lands, and many instances have occurred where men possessing medical qualifications of Government institutions in China and desirous of obtaining another degree from a western university, are obliged to undergo the ordinary student's course of 5 years before such a degree is conferred upon them. In other words the training a man receives as a medical student in China counts for nothing in a western country. Even in our own country our graduates enjoy a lower social standing, and also fewer privileges than medical men of other countries in the matter of Government appointments, such as health officers, customs and railway surgeons, etc. To remedy these we must place our medical education on the same footing as that of progressive nations. The introduction of steamships, railways, telegraphs and other modern means of rapid communication has brought about a new era of progress. New factors have now to be contended with, as with increased rapidity of transit by rail and steamer, greater facilities for the spread of infectious diseases have also come about. To cope with these new dangers, measures, which have been proved beneficial in other countries, must be introduced into our land, and wherever possible improved upon.

6. It is evident from the above that new ideas in regard to health, as understood and practised by almost every one in the west, should be instilled into the minds of both our educated and unducated classes. To this end the existing systems of medical education, the management of hospitals, and the control of public health should be reorganised, so that our country might come into line with the most progressive nations.

7. *Facilities for Medical Education at the Present Time.* I venture therefore to draw attention to the facilities for medical education available in China at the present time and thereafter to indicate in what directions improvement should best be effected.

I. *Government Colleges.*

The medical colleges which have been established by the Government are :—

The Peiyang Medical College, Tientsin.
The Army Medical College, Tientsin.[1]
The Army Medical Colege, Canton.

The Peiyang Medical College was founded twenty years ago by the late Viceroy Li Hung Chang after personal experience of the superiority of western methods of treatment. In its early years the management of the Instistution was in the hands of a British staff, but this work was handicapped from the beginning by inadequate equipment and by an insufficient number of teachers. Instruction was given in the English language, the students coming mostly from Hongkong and Canton. Since 1901 the management has been in the hands of French professors who continue teaching in English. The number of students graduating from this college since its foundation in 1893 has totalled 106. Since 1914 it has become the Naval Medical College.

The Army Medical College, Tientsin, was founded nearly ten years ago by Viceroy (now President) Yuan Shih Kai to train medical officers for the newly organised modern army of Chihli Province. Since 1909 the Board of War, Peking, has taken over the control of the College. The work was at first entrusted to a Japanese staff, the language used being Japanese. Since 1911 all the teachers have been Chinese, mostly graduates of the College, and Chinese has been the language used. From this College about 50 students have graduated annually and have been drafted mostly into the Army.

The Canton Army Medical College was established some years ago to prepare medical officers for the southern army, and the work was entrusted to a staff of Chinese and Japanese teachers.

Besides the above, it has been proposed for some time to found a Medical Faculty of the Government University of Peking, and for nearly two years from 1910 a Dean of this Faculty was appointed, but the appointment lapsed about the middle of 1911. No substantial progress was made.

II. *Missionary Colleges.*

One of the objects of Missionary bodies in China has been to establish hospitals where the sick may be cared for. Many of the larger centres have founded medical colleges for the purpose of training competent assistants to help them in their work. Diplomas are as a rule given after four to five years' training, and a considerable number of these men may now be found practising western medicine in different parts of China. The language used to teach the students has in most cases been Chinese.

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[1] Transferred to Peking since 1918.

The tendency in late years has been to centralise their medical teaching in eight large cities, where sufficient staff, equipment and clinical material are available.

It was decided at the triennial Missionary Medical Conference held in January 1913, that these cities should be Mukden, Peking, Tsinanfu, Chengtu, Hankow, Nanking (or Hangchow), Foochow and Canton.

The following resolutions were also passed :—

1. That the sole object of establishing medical colleges in China is to bring blessing to Chinese people and to give a thorough training in medicine and surgery to young men and women so that they may be of better service to their country.
2. That they have no desire to make these institutions permanently foreign but to hand them over ultimately to the Chinese themselves.
3. That they desire to bring their teaching work into line with the regulations of the Minister of Education and to always cooperate with the Government of the Republic in medical education.

III. *Other Colleges.*

Besides the above-mentioned colleges there exist the following institutions controlled by foreign governments or corporate bodies where Chinese students can obtain their medical training :—

1. The German Medical School, Shanghai
   (Started in 1908 but closed since 1914).
2. The German Medical School, Tsingtau
   (Opened in June, 1911, closed since 1914).
3. The Harvard Medical School, Shanghai
   (Opened in 1912, closed since 1918).
4. The Japanese Medical School, Mukden
   (Established in 1912).
5. The Hongkong University
   (Opened in March, 1911).

Of these five institutions, the German Medical Schools at Shanghai and Tsingtau are supported by the German Government; the Japanese Medical School at Mukden is controlled and supported by the South Manchurian Railway Company; while the Harvard Medical School is an offshoot of Harvard University in America. The Hongkong University, of which the Medical Faculty is the oldest and the most important, is a public institution encouraged and partly supported by the British Government. These centres are essentially for the purpose of giving a sound medical training to Chinese youths, the language employed at the German Schools being German, that at Mukden Japanese, while at the Harvard Medical School and at Hongkong University the medium is English. As they are independent institutions it is not within my province to make any suggestions regarding them. The colleges established by the missions, however, are willing to co-operate with our Government, and their attitude towards this question should, in my opinion, receive careful consideration.

It is well known that the cost of establishing an up-to-date medical college, with its teaching staff and equipments, is enormous. In the present state of our finances, such an expenditure is out of the question, but, as the need of medical education is a pressing problem, the most practical and economical plan should be adopted. Under the circumstances the resolutions passed in January 1913 by the Medical Missionary bodies, who have worked disinterestedly for the good of this country, have come at an opportune moment. As Peking is the centre of our Government, and as one of the best equipped of the missionary medical colleges, namely, the Union Medical College, is also situated there, I would suggest that our authorities consider seriously whether the time is not ripe for arrivng at an understanding, to the mutual advantage of both parties, regarding co-operation in the matter. In this College, the organisation for giving a sound medical education is almost complete. For many years past our Government has supported this institution with monetary grants, and the Board of Education of the Ching Dynasty officially recognised its graduates. If such an experiment proved successful, it would be advisable for the Government to co-operate in the same manner with those medical institutions in the large centres, which have proved themselves efficient.

8. *Standard of Medical Education which should be Adopted.* In all progressive countries medical men are regarded as belonging to one of the learned professions and their advice as experts on all matters relating to the health of the community is accepted both by the state and by the public. This has been rendered possible by the good foundation received by medical men during their college days, and by their desire to improve the health and happiness of the

people around them. In drawing up any standard of medical education, such facts and ideals as mentioned above should be borne in mind.

The minimum period for a medical student to finish his curriculum, that is, the time to be spent on medical education before he is allowed by the State to practise, varies from four years in Japan, five years in Great Britain and America to six years in Germany. And it is significant of the progress of medicine, especially in its scientific aspects, that in Great Britain and America there is at present a strong movement in favour of extending the medical curriculum to a minimum of six years. Further, it must be remembered that before a man is allowed to begin his medical curriculum, he must have passed a preliminary examination in general education of a high order.

In China there is as yet no common standard fixed by the State either of a general education for medical students or of a medical curriculum. The time to be spent on medical studies and the range of subjects taught are left entirely in the hands of individual schools and there is no independent state supervision of examinations. The result is that those graduating from different medical schools vary enormously in the extent of their medical knowledge and clinical experience, and a great many are totally incompetent to carry on the work of their profession with benefit to themselves or their patients.

To remedy these evils the first essential is a Central Governing Body (which may be called the Central Medical Council) into whose hands the Board of Education could delegate its power in regard to medical education. This Council should consist of an Official of the Board of Education and also one representative appointed by each of the medical schools in China approved by the Board. Power might be given to the Council to add to its number by the inclusion of one or more medical men who have taken a leading part in promoting medical science in this country. While the post of member of the Council should be as far as possible honorary, it would be advisable for the Board to sanction an annual appropriation to enable the Council to carry out its multifarious duties.

This Central Medical Council should include among its duties :—*

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* Many of these recommendations have been adopted by the Ministries of Interior and Education since 1916, but the Central Medical Council is not get instituted, W.L.T.

1. The decision of the language or languages to be recognised in the teaching of medical students throughout China.
2. The fixation of a minimum standard of general education required of students before entering upon medical studies.
3. The fixation of a minimum medical curriculum.
4. The supervision of examinations, including, if required, the functions of a Central Examining Board for the whole country.
5. The recognition of medical schools other than those which will have been recognised by the Board of Education.
6. The recognition of hospitals where medical students may obtain their clinical teaching.
7. The drawing up of laws and regulations affecting the medical profession in China and their enforcement.
8. The issuing of a medical register contianing the names of all those qualified to practise medicine in China.
9. The adoption of a general nomenclature of medical terms in Chinese.

It may be of interest at this point to outline briefly a scheme of medical education which, in my opinion, is suited to the needs of this country.

A. *Preliminary Examination on General Education.*

This must be passed before the student enters upon his five years' medical course. It should include :—

i. a knowledge of classical Chinese.
ii. a knowledge of one of the following foreign languages—English, German or French. This should comprise.
    (a) reading, dictation, composition, grammar, analysis, paraphrasing.
    (b) questions on the general outlines of the history and geography of Europe and Asia, and especpecially with reference to China.
iii. Mathematics, comprising Arithmetic, Geometry (Euclid Books I-IV) and Algebra including easy quadratic equations.

This preliminary examination is a necessary step in order to enable the medical profession of this country to reach the same status as in other civilised countries. For centuries past it has been a standing reproach to China that advanturers and men without any general education have been allowed to practise medicine and hold peoples' lives in their hands. Such men, not having studied the real causes of diseases, their diagnosis, and their rational treatment, have brought about untold harm to the nation, and for personal gain have kept the masses in ignorance.

It will also be readily understood that any one having a knowledge of one of the three leading European languages enjoys a higher social standing than one without such knowledge. The future medical men of China should aim at that standing. A general education which would enable candidates to fulfill the requirements of the Preliminary Examination can be obtained, at present, at the higher Government and Missionary colleges found in most of the larger cities throughout China. By a scheme of co-operation with these colleges, the advantages of a medical career might be explained and as much encouragement as possible be given to students to take up the profession. Scholarships and prizes should be offered to the most promising young men as an incentive to others.

B. *Scheme of Medical Education.*

First Year of Study.

Summer Session for 3 months...Botany (Lectures)
,, (Practical)
Zoology (Lectures)
,, (Practical)
Examination in Botany and Zoology.

Winter Session of 6 months...Chemistry (Lectures)
,, (Practical)
Analysis.
Physics.
Lectures in Elementary Anatomy.
Examination in Chemistry and Physics.

Second Year of Study.

Summer Session of 3 months...Practical Anatomy.
Anatomical Demonstrations.
Histology.
Lectures on Elementary Physiology.

Winter Session of 6 months...Practical Anatomy.
Anatomical Demonstrations.
Lectures on Physiology.
Practical Physiology.
Practical Chemical Physiology.
Examination in Anatomy and Physiology.

(Provision should be made for each student to dissect the whole body once before presenting himself for examination in Anatomy).

Third Year of Study.

Summer Session of 3 months...Morbid Histology and Post-mortems
Bacteriology.
Practical Materia Medica.
Surgical Dressings (Out-patients).

Winter Session of 6 months...Lectures in Pathology and Post-mortems.
Lectures in Materia and Therapeutics.
Clinical Surgery.
Examination in Pathology, Bacteriology and Materia Medica.

Fourth Year of Study.

Summer Session of 3 months...Clinical Surgery.
Clinical Medicine (ward work).
Lectures in Medical Jurisprudence.
Lectures in Midwifery and Gynecology.
(During summer holidays to attend midwifery cases.)

Winter Session of 6 months...Lectures in Public Health (first three months).
Lectures in Tropical Medicine (second three months).
Clinical Gynecology.
Examination in Midwifery, Gynecology, Forensic Medicine and Public Health.

Fifth Year of Study.

Summer Session of 3 months...Infectious Diseases (once a week).
Diseases of the Eye,
,, ,, Skin.
,, ,, Ear, Nose and Throat.

Winter Session of 6 months...Lectures on Medicine.
Lectures on Surgery.
Clinical Medicine.
Clinical Surgery.
Vaccination (once a week).
Dispensary Practice.
Examination in Surgery and Medicine.

Final Qualification to practise Medicine and Surgery.

All subjects in a Medical curriculum should be designed to enable a student to obtain a proper conception of clinical medicine and surgery. Therefore it is best that a student should devote all his time during the second year to Anatomy and Physiology, and so acquire the requisite knowledge of these subjects before beginning clinical work. In this connection I cannot emphasise too strongly the urgent need of allowing dissections to be carried on at medical schools. For too many years already the medical schools in China, both Government and Missionary, have tried to avoid this most important part of medical education, and the result has been very unsatisfactory. It is impossible to obtain a proper idea of the structure and functions of the human body without dissection, and the paper and wax models hitherto used in institutions have failed to serve the purpose. The great objection to dissection in China has been the belief in ancestor worship. But the same objection was lodged against the first railways built in China owing to the removal of graveyards—a reason not heard of nowadays when the people realise the need of rapid communication. Again, the Japanese who possess similar religious beliefs to ours, have allowed dissections and post-mortems since they adopted western medicine and the result is that their medical graduates are nowadays equal to any in the world. The Orders published by the Board of Education and Board of Justice some months ago sanctioning dissection in medical institutions is therefore a very welcome one.

To give less than one whole year to Anatomy and Physiology—the two foundation subjects of medicine—or to devote part of the time to clinical work does not give the student an opportunity of deriving the full benefit of clinical instruction.

Pathology comes as early as possible, since without an accurate knowledge of the processes of disease, a student cannot properly understand the conditions met with in his clinical work. Here again, the value of post-mortems and the establishment of proper departments in hospitals for performing them cannot be too strongly insisted upon. Even with such a course, the ideal thing would be to encourage a promising graduate to spend one year as House Surgeon or House Physician in an approved hospital after qualification.

Since medicine is a progressive science, it must be remembered that one of the important duties of a medical school is to make arrangements for post-graduate teaching so that a doctor may return from time to time to become acquainted with the latest additions to the methods of diagnosis and of treatment.

Moreover, the great advantage of a graduate studying for some time in a foreign country must not be lost sight of. Facilities should be given for the most promising men to carry on advanced work in the hospitals and laboratories of western countries so that they may be fully equipped with all new knowledge to return to China and undertake either teaching or independent investigations on the diseases and drugs met with in this huge country.

9. *Language.* The question of language to be adopted for medical education in China must for many years be a difficult problem . Until our medical schools can produce men of sufficient experience, the teaching staff of the college must necessarily be composed of graduates of western universities. Whether Chinese or foreign, such graduates cannot acquire a good working knowledge of the Chinese language for teaching and scientific purposes without many years of preparation. It may be mentioned at this point that since the number of Chinese who have graduated abroad is still limited, the employment of foreign teachers to assist them will be necessary for some years to come. But while the language difficulty may occasionally be overcome as in the case of a few missionary institutions where the teaching is carried on in Chinese, a much stronger plea for a knowledge of a western language lies in the fact that, at the present time, practically no medical literature exists in Chinese. Unless a graduate is able to follow in the medical and scientific journals the progress which modern medicine is making day by day, his knowledge will remain stationary, if it does not actually

deteriorate, from the time he leaves the influence of his teachers. This being so, the question arises which foreign language is the best adapted for a medical student. Hitherto, owing to greater facilities in Germany for the investigation of all matters relating to medical science, a knowledge of the German language has been essential to progressive medical men, but at the present time western scientific workers are practically unanimous that during the coming years the greatest advances in medicine will be made in America. This is due to the splendidly equipped hospitals and laboratories founded by charitable people, and ample funds at the disposal of the medical profession in that country. On this account and also because of the fact that English is more commonly used than any other foreign language in China, it seems best to adopt it in addition to Chinese for our medical schools, and English might also profitably be the medium used for a considerable part of the teaching. If this suggestion be adopted, it will necessitate English being made a compulsory subject in the Preliminary Examination. (q.v.) As in Europe so in China, the medical man who desires to be up-to-date and respected in his profession must possess a work knowledge of at least one of the recognised scientific languages besides his own.

10. *The Place of the Hospital in Medical Education.* Although the best hospitals at the present day, as seen in America, have cost millions of dollars, simpler and less expensive buildings can serve the same usedul purpose in our country. But for this to be possible, they should from the very first be built and managed according to the standard requirements of progressive medicine.

Besides serving as institutions where the sick and needy may derive the fullest benefit of scientific medicine, those hospitals associated with teaching schools form so integral a part of medical education that they must be considered as actual departments of such schools. The medical schools generally regarded as the best for teaching purposes are those where the different hospitals for general and special diseases are built to suit the needs of the various branches of medical science. The senior physicians and surgeons of these hospitals are *ipso facto* heads of their respective departments in the university; in other words they have the control of all the teaching in the subject dealt with in their departments.

At the outset it must be clearly realised that although the hospital is intended primarily for the treatment of patients, in its relation to the medical student it is to serve merely as an institution for his instruction. The proper working of the hospital in regard to the patients is carried on entirely without his help. If the care of patients at the hospital depends upon the student for its efficiency then his education inevitably suffers. He must fulfil the duties of a nurse or dresser to such an extent that time is not available for him to study, as thoroughly as desirable, many of the subjects in his curriculum. It is, of course, essential that the student should do dressing, etc., in the wards, and assist at operations, but this is to be for his own benefit; the hospital does not rely on him to carry out this part of the routine work. A staff of medical officers assisted by trained nurses, dressers and orderlies is maintained for the adequate performance of all matters pertaining to the hospital and its patients.

As it is in the hospital that the student first comes in touch with the many phases of disease and practises the essential principles of surgical cleanliness, of carefulness and accuracy in observation, of discipline in the management of the sick, and of sympathetic association with patients, habits which ought to be displayed throughout his whole professional life—it stands to reason that those in charge of the hospital carry a heavy responsibility on their shoulders, and should both by teaching and precept instil these principles into the minds of their students.

Lastly, the medical profession besides being practical is essentially a humane one; and those responsible for the training of our medical students must continually infuse into them the spirit of benevolence and helpfulness to others. The importance of a student doing even the simplest things with his own hands cannot be over-estimated; it is only by practice and minute attention to details that his skill as a physician or surgeon will be fully developed.

11. *Concluding Remarks.* For several years past our country has been trying to keep abreast of the times. We have encouraged the building of railways, the spread of telegraphs, of telephone, and electric light, the advancement of education, the improvement of the army and navy, the cultivation of friendly relations with foreign peoples, and many other things. We have also built hospitals and established medical schools for the training of modern doctors, but we have not given up our old ideas of medical practice. For example, in many places where the Government have established a modern hospital officered by men trained in western methods, another hospital, where native medicine is practised, is also maintained. Again, in the army, medical work is divided between two classes of army surgeons—the western-trained and the native-trained. Those supposed to be suffering from internal complaints are treated by the latter, while wounds and abscesses are relegated to the former.

By this means not only is double expense incurred, but on the face of it the method is absurd. Either modern medical methods are superior to the old methods, or the old methods are superior to the modern. If old methods are better they should be retained, and the modern methods abolished. If, on the other hand, modern methods are better—and this has been proved in all up-to-date countries, including Japan, whose people used to have the same ideas as ours—they should be wholly adopted and steps should be taken for a gradual merging of the old into the new one.

As is well known, many of the drugs used by native practitioners show excellent results in certain diseases, and some of the methods of treatment used by them are satisfactory. But in the majority of cases, the treatment is purely empirical, and for these drugs and methods to give the greatest benefit they must be thoroughly investigated and their mode of action accurately ascertained.

Again, the western trained doctor in China is neither treated fairly nor encouraged to be up-to-date. When a foreign practitioner is asked to attend a case payment is duly accorded him, but a Chinese western trained man seldom receives any fee for even the most skilful treatment. His results at hospital are compared not with methods superior to his own with a view to healthy rivalry, but with inferior methods. Thus he becomes misled in time into a belief of having reached the ideal and entertains no incentive to improve in his profession. Very few of the graduates of the present medical institutions in China are as yet able to perform other than minor operations. Abdominal operations are seldom attempted even when urgently needed to save life, and brain surgery is unknown.

Properly managed medical schools with their attendant hospitals where a sound education in modern medical science can be obtained are hence indispensable for the welfare of our nation. Graduates of these schools should be of such a standing as to be recognised by the world in the same way as those of Japan and the recently established Hongkong University. Such graduates must not be inferior in knowledge to those of other nations, and must keep up with the discoveries made almost every day in medical science. Above all, they must ever bear in mind the value of Preventive Medicine, and not only practise it themselves, but spread its doctrines among the people with whom they come in contact.

It is only by a thorough reorganisation of medical education on the above lines that we can hope to appoint, with credit to themselves and their country, our graduates to the more important posts at present held by men taught in other lands. With an efficient medical service consisting of our own men, the present conservative attitude of our people towards western medicine will change for the better, and China will henceforth rid herself of the unenviable name of being the most backward nation in medicine and sanitation.

12. *Summary.* I venture to close this memorandum with a brief summary of what I have stated in the foregoing pages.

(a) Although Chinese ideas of disease and medical practice were useful in the olden days and are still useful in certain diseases, a complete reform is necessary to enable our people to successfully cope with present day conditions.

(b) To attain this our medical colleges and hospitals must be reorganised so as to produce the maximum of good results with the minimum of expense.

(c) Our medical students must be given not *a* medical education but *the* standard medical education so that they can come into line with graduates of all civilized countries.

(d) As a proper knowledge of Anatomy and Pathology is absolutely essential for medical students, medical schools and hospitals recognised by the Government should be allowed to perform dissections and post-mortem examinations.

(e) A Central Medical Council for medical education should be established in Peking by the Board of Education consisting of an official of the Board and also one representative appointed by each of the recognised medical schools in China, as well as one or more medical men who have rendered signal service to medical science in China. This Council should have, among other duties, the power of fixing the medical curriculum, granting licences to practise medicine, and supervision of examinations throughout China.

(f) As it will be some time before the Government is able to equip an up-to-date medical college, it may be advisable in the meantime to take over either partially or completely any non-Government medical institutions which show a desire to co-operate with the Government.

(g) The standard of a nation's progress is often judged by its management of affairs relating to the public health; that being so, it is of the first importance that China should not fall behind other countries in the matter of medical education and medical practice.

Harbin, 15th January, 1914.

MEDICAL PROGRESS IN CHINA SINCE THE REPUBLIC.

Reprinted from the Lancet (London), 1920.

In spite of the disturbed state of the country since the establishment of the Republic in 1911, the progress of medical and sanitary science has been very marked and steady. This has shown itself in two ways: (1) the readiness with which both the Central Government and the provincial authorities have established and supported hospitals and institutions of a sanitary nature; and (2) the increased interest shown by the general public in Western medicine, home cleanliness, and matters bearing a hygienic value.

The era in modern preventive medicine may be said to have commenced in 1911, when the Chinese Government and people noticed the great superiority of accurate scientific methods, as compared with crude haphazard methods for the suppression of the pneumonic plague in Manchuria. On one hand, they saw a body of clean, earnest, and fearless young men equipped with knowledge, microscopes, instruments and disinfectants and succeeding in their work of suppressing the epidemic; on the other, they encountered talkative, old-fashioned, uncertain men, whose one idea was to needle and drug the patients and who, because they took no precautions against the disease, died as easily as the patients. One great result of this epidemic was the establishment of the North Manchurian Plague Prevention Service, consisting of hospitals at Harbin, Tsitsihar, Sansing, Newchwang, Taheiho, Manchouli, and Lahasusu. Harbin, being the commercial center of North Manchuria and also the principal focus of infection in 1911, has the largest hospital, covering an area of six English acres and containing an up-to-date bacteriological laboratory capable of handling all sorts of bacteriological research. In ordinary times, when no epidemic exists, these hospitals are used for general purposes, surgical operations being performed and inpatients suffering from various ailments being admitted for treatment. The Medical Staff of the Plague Prevention Service consists of ten male and two female doctors distributed among the different hospitals. Inside the hospital at Harbin, there is a fine medical library, much patronized by the American and other foreign doctors of this city. An interesting museum of medical objects is also attached to it. Besides annual medical reports, the Plague Prevention Service has published two voluminous scientific reports containing research and other matters carried out by members of the Service. Now and then, as during the last summer, another epidemic, namely cholera, claimed the attention of the staff. Although very severe, it was suppressed within six weeks with the low mortality of fourteen per cent, as compared with a mortality of fifty to sixty per cent in other cities, where the outbreak did not subside until the end of November.

In November, 1913, a Presidential mandate was issued authorizing the dissection of dead bodies in China. This, together with the imperial sanction of cremation of cadavers from plague in 1911, has undoubtedly paved the way further for medical progress in China. Another interesting landmark in the annals of medicine in this country, was the foundation of the National Medical Association in 1914, when thirty medical graduates from European, American, Japanese, and Chinese colleges met together in Shanghai and formed the nucleus of the Association. It has now a membership of over 450 male and female members. The first President was Dr. Yen Fu-ching, M.D., of Harvard and the second Dr. Wu Lien-teh. So far, two conferences of the Association have been held, once in 1915 (Shanghai) and once in 1916 (Canton). The third one will be held this year (1918) in Peking in conjunction with the Medical Missionary Association, at which it is expected famous anatomists, physiologists, and specialists will attend from various parts of the world.

On September 30, 1915, an important mandate was issued recognizing Western medicine as the proper standard of medical practice in China. Any one practicing medicine in the country, will henceforth be required to produce a certificate from the Police. It would be better if this power were centered in the hands of a recognized Central Medical Council, but until that comes into being, the police permit will have to stay.

Up to 1915, Peking had no proper hospital for the treatment of infectious disease, such as scarlet fever, diphtheria, typhoid, etc. Thanks to the liberal policy of the then Minister of Interior (Mr. Chu Chi-chien), a hospital for this purpose was built on tenth street, North City, capable of accommodating sixty beds. This hospital has done creditable work under the combined direction of Yen Chi-chung (graduate of Tokyo University) and Dr. S. P. Chen (M.B. of Cambridge). Cases of small-pox are now sent to the Auxiliary Epidemic Hospital in the grounds of the Temple of Heaven outside Chien Men.

The year 1914 saw the visit to this country of a commission of medical experts appointed by the Rockefeller

Foundation to consider the possibility of establishing two first-class medical colleges in China for the training of future Chinese doctors. Another commission followed in 1915, and as a result it was decided to found two well-equipped colleges and hospitals, one in Peking and the other in Shanghai. The one in Peking is now nearly completed and will be formally opened in the fall of 1920. The cost of this place has approximated five million gold dollars, and it is expected that the annual budget will not be less than one million, though only one hundred students will be trained at one time. When finished, and in working order, the Rockefeller Medical College and Hospital of Peking will eclipse anything in existence in Europe or Asia in the magnificence of its architecture and the completeness of its outfit.

The Peking Central Hospital, upon which the writer devoted the best part of four years in collecting funds, constructing and equipping, was finally opened on January 27, 1917. The total cost is $300,000 and it is intended to serve as a model hospital for every Province in China. It is modeled upon the American plan and possesses three stories and a basement. It contains four large wards, each accommodating twenty-five beds as well as a series of fine private rooms for first and second class patients. Until the opening of the Rockefeller Hospital the Central Hospital will stand as the finest institution of its kind in China or Japan.

As a result of the second visitation of pneumonic plague in Shansi, China, in 1918, the Central Government devoted the balance of the one million loan (obtained for the suppression of the epidemic) to the establishment of the Institute for Infectious Diseases in the grounds of the Temple of Heaven—a beautiful spot covered with pine trees. Here a series of isolated red brick buildings have been erected for the different departments of the Institute, e.g., Investigation, Serumtherapy Veterinary, Chemical, etc. Over forty experts, mostly graduates of Japan, are connected in one way or another with the Institute. During the last summer, when cholera threatened Peking and the vicinity, this Institute distributed vaccine made in its laboratories for use among the troops. The Chemical Department undertakes to analyze patent medicines and chemicals submitted to it for a fixed fee. The Institute is connected with the Ministry of Interior and comes directly under the Department of Sanitation.

The first Medical College established in North China is the Peiyang Medical, now Naval Medical College, founded in 1893 by Viceroy Li Hung-chang in remembrance of the services rendered to his family by the British missionary Dr. Mackenzie. After Dr. Mackenzie's death, several past students of the College were appointed Directors, of whom the most prominent was Dr. W. T. Watt. The present staff consists of Dr. H. Y. King (Director), four French, one British, and ten Chinese professors. The Army Medical College was started in Tientsin in 1903 by Viceroy Yuan Shih-k'ai, the first Director being Dr. Hsu Hua-ching, one of the first four graduates of the Peiyang Medical College. In 1918, this College was transferred to Peking. As at present constituted it occupies an enormous area in the east city between Fifth and Tenth Streets, the ground comprising nearly forty acres. Besides the College and Hospital, there will be built the Veterinary College and the Military Drug Factory. The whole place is under the efficient management of Surgeon General Chuan Shao-ching. The total cost is in the neighbourhood of $800,000.

A notworthy feature of this medical progress is the increasing co-operation of Chinese and foreigners. Instead of adopting an exclusive policy, missionary institutions are inviting more and more the assistance of their Chinese colleagues. This broad-mindedness is a wise one, for the natural teachers, healers, and research workers in China are the Chinese themselves, many of whom have now received a first-class training abroad. In this respect, the China Medical Board of the Rockefeller Foundation is more far-seeing than the authorities of the Hongkong University, for it has already on its staff at least twelve Chinese doctors out of a total of thirty-three teachers.

Other institutions which have contributed considerably to the progress of medicine in China are the Yale Medical School in Changsha (Hunan); the Union Medical Department of the Shantung Christian University (Tsinanfu); the Kung Yi Medical College and Hackett Medical College (both in Canton), at the latter women receive a good training; the French Medical College in Canton with which is affiliated the Hospital Doumer; the Sino-French Medical College at Changtehfu (Honan) to which is attached a small Institut Pasteur; and the Medical Department of the French Catholic University of Aurore in the French Settlement of Shanghai.

One institution, unique in its way, has perhaps done more than any individual school for the propagation of hygienic ideas among the masses. This is the famous Tsinanfu Institute, founded in 1905 by the Reverend J. S. Whitewright of the English Baptist Mission. The buildings cover over three English acres and have cost over $150,000. About half a million persons visit the Institute in the course of one year. There should be at least one such institute in every large city in China for the training of the masses in modern progress, including hygiene.

An interesting advance has been made in the appointment of a Terminology Committee, consisting of representatives of the Ministry of Education, National Medical Association, Medical and Pharmaceutical Society, Medical Missionary Association, and Kiangsu Educational Association, to determine the terms to be used throughout China. So far, the complicated terms of anatomy have been finished and accepted by the Government as official. The terms in bacteriology, chemistry, and physics have also been finished and are awaiting recognition.

It is generally acknowledged that until the poorer classes practise hygiene, as well as the educated classes, infectious and other communicating diseases will not be stamped out. Knowledge of simple laws of health are, therefore, essential among high and low. With a view to carrying out such work, the Joint Council of Public Health Education was formed in 1916, consisting of representaties from the Y.M.C.A., National Medical Association and Medical Missionary Association, with offices at 5 Quinsan Gardens, Shanghai. The two secretaries are Drs. W. W. Peter and S. M. Woo. Their method of work consists in preparing travelling exhibits of automatic models, plans, lantern slides, movies and other methods by which the attention of the audience may be arrested and retained. Besides the above hundreds of thousands of pamphlets and booklets have been issued and sold at cost price. Among the titles of these books may be found: How to live, First Aid in the Home, Sanitation of a Chinese City, Tuberculosis, Infant Hygiene, Plague, Smallpox, Venereal Disease, Care of Teeth, Care of Eyes, Cholera, Sexual Hygiene for Young Men, etc. These books have had an enormous sale, showing that the public are interested in promoting hygiene.

Pressing-needs in the Medical Line. Acting on the principle that "Discontent is the essence of progress", I am still far from satisfied with the speed at which sanitary matters have been undertaken by the authorities. The public health of the country should be invested in the hands of a business like Central Health Bureau, with power to control epidemic diseases, and distribute vital statistics, manufacture vaccines, and perform analysis. In addition, a Central Medical Council should be established in Peking, consisting of leading medical men as well as representatives of the Government for the control and supervision of medical education and practice. The time has come when the old-style methods of practice should be absorbed into the modern methods, or else prohibited entirely in a limited number of years. The present system of simultaneously employing native-trained and western-trained medical officers in government hospitals and in the army is wasteful and backward. Hygiene should be more widely taught in elementary and high schools, and properly trained school doctors employed to supervise the health of the pupils, so that all their defects, if any, may be at once discovered and corrected instead of being allowed to undermine the health and often shorten the lives of the children. The supervision of public health should be in the hands of proper sanitary boards, comprising leading physicians and business men as well as the police authorities. Social leagues should be founded wherever possible by leading citizens, men and women, and future mothers taught practical details for the management of a healthy home and family. The present tendency among the people, especially women, to buy patent medicines for headache, constipation, menstrual pain, backache, sleeplessness, and even sterility, is widespread, and can only be stopped by a fuller understanding of the laws of nature and a higher conception of the ethics of the medical profession. It may be further promoted by access to such public institutions as natural history museums, public health exhibits, industrial museums, commercial and technical displays, throughout every large city in the land. As the trade of the country expands, and technical and commercial education becomes more popular, these institutions will no doubt be established.

Wu Lien Teh.

THE MENACE OF MORPHINE.

(*Paper read at the Joint Medical Conference, Canton, 1917.*)

The year 1917 will be made historic as the one in which opium, which has been the curse of China for seventy-five years, will be officially and finally banished from the country. For in this year the ten year agreement made between Great Britain and China regarding its importation into this country including the last two seaports of Shanghai and Canton will come to an end, so that even in the British Settlement of Shanghai the last opium shop will be closed by the month of March. The whole nation will rejoice at this happy termination of an awful vice, which once looked as if it would exterminate our race. That the drug is scarce may be ascertained by the fact that the present price in Canton is at least $15. per ounce, with a tendency to rise. Except for some smuggling from Turkestan and Russia by way of Siberia very little opium will in future find its way into China, though the Government and Customs authorities will still have to exercise the greatest vigilance in dealing with this enormously paying business by unscrupulous people.

If we are thankful in regard to opium, I am afraid we cannot say the same of morphine, its derivative, for up to the end of last year all statistics point to its increased importation into China. The supply of morphine comes mainly from two firms in Edinburgh and one firm in London. The following table shows the declared exports of morphine from Great Britain alone:—

1911...108,546 ounces, equal in weight to 5½ tons.
1912...276,572 ,, ,, ,, 7½ ,,
1913...406,154 ,, ,, ,, 11¼ ,,
1914...504,202 ,, ,, ,, 14 ,,

It is estimated that the exports in the years 1915 and 1916 will be at least 600,000 ounces for each year, equal to over 16 tons.

There are some interesting points which I should like to draw your attention to. The normal importation of opium into Japan for medicinal purposes is only 10 chests a year, but the importations of morphine into that country in 1911 was 1½ tons; in 1914 it had risen to 12 tons, that is, one ton a month. There is a large firm in Japan which acts as agents for the manufacturing firm in London. In 1913 alone this agent in Japan imported two and half tons of morphine by registered post via Siberia. Two other British firms exported two tons by the same method, and one and three-quarter tons came from Germany, making a total of 6¼ tons in 1913. So far it has been ascertained that neither Japan nor Germany has got the necessary plant to manufacture morphine on any large scale, and the alkaloid has come mostly from the three old firms in Great Britain. Once arrived in Japan, the morphine is usually made up into small packets or placed into small bottles, labelled in different ways, such as, morphine, white powder, soothing stuff, dreamland elixir, etc., and exported openly or smuggled secretly into China, usually by way of Dalny, Antung and Formosa. Almost every Japanese drug dealer or pedlar in Manchuria sells it in one form or another, and does so with impunity, because no Japanese can be arrested without first informing the consul. From these Japanese agents and sub-agents, the drug may be passed on to disreputable Chinese who frequent the coolie depots and inject a solution, usually very dirty, with a hypodermic syringe, which may be made with glass, metal or even bamboo. Rigorous imprisonment for two years is a common sentence for Chinese found with morphine in their possession, but I fear that the principal culprits usually escape punishment.

It is now some years since I left off working in the south, and am not conversant with conditions in the Straits, Kwangtung and Fukien. The morphine habit was first brought into China by returned emigrants (Swatow) from Singapore and spread rapidly to other parts of Fukien. But during my five years in Manchuria I have seen terrible havoc wrought upon the population by this insidious drug. More than half of our regular jail birds show needle signs all over their bodies, professional beggars found in the streets of Harbin, Kirin, Changchun and Tistsihar are victims of the habit, and thousands of poor people die in the large cities during the winter months, partly from cold but principally from inability to work on account of their morphine habits. From all sources I learn that the evil is spreading rapidly. It is of course worse than opium smoking, for at the cost of 4-5 cents a coolie could satisfy his craving and obtain immediate satisfaction. Enormous profits are made by the dealers in this illicit trade. The average wholesale price of morphine hydrochlorate in London is 10/5 per ounce, but the Japanese pedlar sells it in China for £5-10 to £8 The profits made by the dealers in China in 1913 amounted to £840,000, on 6¼ tons. Since the advent of Japanese influence into Shantung, the morphine danger has shown itself extensively in that province, and it is heartrending to see huge fellows completely wrecked by addiction to it. Unless strong action is taken by our profession, as was done by us in the case of opium, the morphine evil will assuredly spread further and render futile all our efforts in the direction of opium eradication. The usual energies of the people, and perhaps their industrial and moral stability will be sapped, for the evil effects of morphine are displayed in the victims much quicker than those of opium. The question is. "What are we to do?"

You may recollect that three Opium Conferences have already been held at the Hague, in 1911-12, 1913 and 1914. At the first a Convention was drawn up in which all the participating Powers (Germany, United States, China, France, Great Britain, Italy, Japan, the Netherlands, Persia, Portugal, Russia and Siam) agreed to mutually help one another in restricting the evil effects of opium, morphine, cocaine and allied drugs. At the Second Conference, thirty-four out of the forty-six Powers of the world agreed to adhere their signatures to the Convention, and at the Third Conference the United States, the Netherlands and China deposited their ratifications so as to act upon the articles of the Convention. Although the representatives of Great Britain were instructed to declare on behalf of their Government at the Second Conference their readiness to ratify, the matter has so far been delayed. In the meantime the war has put a stop to many things, but morphine continues to find its way into China. Two articles in the Convention signed on Jan. 23, 1912 deal particularly with morphine and allied alkaloids, thus :—

> *Art. 9.* The Contracting Powers will enact pharmacy laws and regulations so as to limit the manufacture, sale, and use of morphine, cocaine and their respective salts to medical and legitimate uses only, unless such Laws already exist. They will co-operate among themselves in order to prevent the use of these drugs for any other purpose.
>
> *Art. 14.* The Contracting Powers will apply the laws and regulations for the manufacture, import, sale or export of morphine, cocaine and their respective salts to (a) medicinal opium , (b) to all preparations (official and non-official, including the so-called anti-opium remedies) containing more than 0.2 percent of morphine or more than 0.1 percent of cocaine; (c) to heroine, its salts and preparations, containing more than 0.1 percent of heroine; (d) to every new derivative of morphine, cocaine or their respective salts, or to any alkaloid of opium which, as the resalt of scientific research, shall be generally recognised as giving rise to analogous abuse or producing the same injurious effects.

If these articles had been put into operation, along with the rest of the machinery provided in the Convention, a great deal would have been done towards controlling the production and distribution of drugs of addition throughout the world, and restricting them to use for medicinal and legitimate purposes only. As it was, the war came on, and both Great Britain and France were obliged to introduce severe laws against the illicit use of morphine and cocaine by the army and inhabitants. A later Government order announces the entire prohibition of the importation of opium into Great Britain except with the sanction of the Government. It is hoped that this will result in the limited manufacture of morphine, so that as little as possible of that alkaloid may find its way out of the country.

If proper pharmacy laws are enacted in China, the problem of morphine eradication will be really an easy matter. Unlike opium, it has never been declared as an article of commerce, and our Government has always regarded it as a prohibited drug. Once Great Britain refuses to sanction its export outside except directly to foreign Governments or legally qualified agencies, the question of smuggling will not be such a serious affair. The Customs laws regarding the importation of morphine and hypodermic needles into China are somewhat crude and inflict much hardship upon qualified medical men and apothecaries. One meets with such a phrase as "qualified foreign medical practitioner," which if taken literally will exclude Chinese medical men qualified in Europe or America from importing or using this drug for the most humane purposes. Again, by existing laws a hypodermic syringe is at present regarded as an instrument solely for injecting morphine and cocaine, and a Chinese medical man is unable to obtain it for the injection of emetin, pituitrin or any of the important new drugs.

As matters remain at present, the real culprits escape, whilst every difficulty is placed before *bona fide* practitioners and properly accredited apothecaries for the importation and use of these drugs and syringes. I would suggest that this Conference pass some resolutions e.g. (1) Drawing attention of the Government to the menace of morphine in China and to the importance of taking immediate steps to put a stop to it by cutting the supply from the source. (2) Asking the Government to enact without delay proper pharmacy laws to regulate the position of dispensers and pharmacists in charge of drug shops, the sale of morphine, cocaine and other deleterious drugs and poisonous chemicals. If required these two Associations would depute some of their members to render the necessary assistance in drafting the laws. The establishment of a Central Medical Council would facilitate such matters immensely.

WU LIEN TEH.

THE LATEST PHASE OF THE NARCOTIC PROBLEM.

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In a paper on the "Menace of Morphine," read at the Canton Conference, I traced the development of the morphine trade, produced some statistics showing the ever-increasing quantity of its production, and appealed to my colleagues to take a share in stopping this terrible traffic. Three years have now passed since that address, but I regret to say that in spite of the greater activities of the press, the workers, and the sympathizers; in spite of further protestations of friendship and co-operation on the part of several governments and officials concerned; and in spite of greater restrictive measures introduced by our government authorities, including the customs, the quantity of morphine reaching this country during the last few years has increased enormously.

My figures of morphine imports, mostly surreptitious, brought up to date, are as follows:

Year.		*Ounces avoirdupois.*	*equal to tons.*
1911		208,540	5½
1912		276,572	7½
1913		406,154	11¼
1914		504,020	14
1915	about	600,000	16
1916	,,	600,000	16
1917	,,	800,000	22½
1918	,,	800,000	22½
1919	,,	1,000,000	28

Is it imaginable that the world will continue to tolerate such a condition of affairs, in which a nation, numbering nearly one third of the human race, eminent in history and brimful of future possibilities, harmless, peaceful, and industrious, is being slowly poisoned to death by the callousness of morphine-producing countries and the rapacity of a mere handful of manufacturers and smugglers? Can it be that after the sufferings and devastations of the last few years of war the nations, which have fought for right, justice, and humanity and eventually triumphed, will still look on unconcerned at this scandalous state of affairs? Above all, will not more medical men and women throughout the world, who of all persons understand best the insidious effects of narcotics, interest their friends in the complete eradication of this traffic, except for purely medical purposes? For I venture to predict that, unless nipped in the bud in time, this narcotic habit will travel as influenza and syphilis have done, in fact become a pandemic.

The literature of opium and similar drugs is already voluminous but a summary of the most important points in connection with its international aspect may be of interest to you.

Hague Conventions.

The first Convention was signed on January 23, 1912, by twelve Powers, including China, America, Great Britain, France, Germany, and Japan.

At the second Conference of 1913, 34 out of 46 Powers of the world had signed the Convention. At the third Conference, June, 1914, 44 out of 46 Powers had signed the Convention and 11 had ratified it. By an important Resolution at the Conference, a special Protocol was opened at The Hague for the signature of such Powers as were willing to proceed to put the Convention in force without waiting ratification by other signatory Powers. The countries who signed this Protocol were China, America, the Netherlands, Norway, and Honduras. The World War then broke out and put a stop to further international action.

The Peace Treaty, which was signed on May 30, 1919, between the Allies and Germany, contained the following valuable article in relation to the opium trade (Part X, Section II, Article 295):

> Those of the High Contracting Parties who have not yet signed or who have signed but not yet ratified the Opium Convention signed at The Hague on January 23, 1912, agree to bring the said Convention into force, and for this purpose to enact the necessary legislation without delay and in any case within a period of twelve months from the coming into force of the present Treaty.
>
> Furthermore, they agree that ratification of the present Treaty should in any case of Powers which have not yet ratified the Opium Convention be deemed in all respects equivalent to the ratification of that Convention and to the signature of the special Protocol which was opened at The Hague in accordance with the Resolutions adopted by the Third Opium Conference in 1914 for bringing the said Convention into force.
>
> For this purpose the Government of the French Republic will communicate to the Government of the Ne-

therlands a certified copy of the Protocol of the deposit of ratifications of the present Treaty, to accept and deposit the said certified copy as if it were a deposit of ratifications of the Opium Convention and assignature of the additional Protocol of 1914.

It will be seen from the above that this Article provides for the ratification and enforcement of the Opium Convention of 1912, alike by signatories and nonsignatories, who have hitherto failed to ratify, as well as the indorsement by them of the special Protocol adopted by the Third Opium Conference in 1914. In other words, Article 295 has now come into force with the ratification of the Treaty by Germany on January 10, 1920, as well as Great Britain, France, Japan and Italy, and these countries are expected to introduce measures forthwith for the control and regulation of the production and manufacture of opium and similar narcotics.

So far as Great Britain is concerned, the necessary laws will soon be introduced, as the following Parliamentary reports show:—

December 4, 1919. Sir Agg-Gairdner asked the Home Secretary when he proposes to introduce the Bill which has been drafted to give effect to the terms of the International Opium Convention, 1912, in order that pharmacy legislation in Great Britain may be in accord with the Convention and the requirements of Article 295 of the Treaty of Peace.

The Home Secretary (Mr. Shortt) said, "I hope a Bill for the purpose mentioned may be introduced early next Session."

December 5, 1919. In reply to a question, Mr. Cecil Harmsworth (Under-Secretary for Foreign Affairs) said, "Paragraph 3 of Article 295 of the Treaty of Peace implies clearly that ratification of the Peace Treaty is to be interpreted as covering both ratification of the Opium Convention and signature of the Special Protocol which was opened at The Hague in accordance with the Resolution adopted by the Third Opium Conference of 1914 for bringing the said Convention into force; all the more then must it be held to cover signature of the Special Protocol in the case of those Powers which have ratified the Opium Convention."

Difficulties of Anti-Opium Work.

Unless International action as provided in The Hague Convention and Peace Treaty is taken, so that the governments of opium and narcotic-producing countries may supervise and control their production and manufacture and sale at the source of supply, even a strong government will find it difficult to fight the wily smugglers and their extensive ramifications. What can Chinese government regulations, laws, customs officers, anti-narcotic societies, do when advanced countries like Great Britain, America, and Japan produce and export unlimited quantities of morphine, heroin, without any question or supervision as to their ultimate destinations; when foreign post offices abound throughout the principal cities of China over which the Chinese government has no control whatever; when nationals of extraterritorial countries, including some of the most unscrupulous men on earth, can ply this nefarious trade with impunity except an occasinal fine when caught; when notorious morphine smugglers are elected mayors of cities; when powerful military officers can transport opium seeds from place to place, grow poppy and collect tax therefrom; when important seaports of China, like Tsingtau and Dairen, are used as centers of smuggling for thousands of piculs of opium and tons of morphine annually? Lest I overtax your patience, let me enumerate to you some of the extraordinary conditions we have had to contend with:

1. Until The Hague Opium Convention is ratified by every one of the 46 Powers of the world, it does not come into force, even though some may have ratified.
2. Opium, morphine, heroin, cannot come direct into China (as these are prohibited by law), but the government of Great Britain allows tons of morphine to be exported to Japan yearly. In 1918 the official Japanese statistics showed 600,228 ounces as having been imported into Japan from Great Britain.
3. In 1918, the Japanese trade returns showed 113,000 ounces of morphine as having been imported from America.
4. In 1919 America imported 564,000 pounds (252 tons) avoirdupois of raw opium during the first ten months, presumably for the manufacture of morphine.
5. Besides Kobe and certain ports of Japan, the following ports are utilized by wealthy and influential smugglers for sending opium and morphine into China: Taiwan (Formosa), Tsingtau, Dairen, Antung, Hongkong, Macao, Singapore, Kwangchowwan, Saigon. At places like Hongkong, the opium monopolists derive a large part of their profits and

pay the government dues from the smuggling of these drugs into China.

6. There is reason to believe that through Tsingtau alone at least 2,500 chests of opium were smuggled yearly into the province of Shantung, and that the Japanese authorities levied a tax of Tls. 4,000 per chest (though this did not appear in the estimate).
7. The profit on 6¼ tons of morphine to Japanese smugglers in 1913 was estimated at $8,400,000. In 1918, if the quantity imported were 22½ tons, this profit would be $30,240,000. No wonder the trade prospered among high and low.
8. With few exceptions every Japanese druggist, brothel-keeper, pawn-broker, peddler, and petty shopkeeper in China is a potential morphine seller.
9. Up to 1915 practically the only countries that manufactured morphine were Great Britain and Germany. With Germany eliminated the trade from Great Britain increased, and Japan imported the drug direct. Since the outcry of the last two years and the agitations of anti-opium and similar associations the traffic has deviated from the former route and now goes via America and other countries. The alkaloid is now purchased from the manufacturers on the spot and sent out undeclared with other goods, hence does not appear in the trade returns.
10. Large factories have been established or are in course of construction in Formosa, Osaka, and Dairen by Japanese for the manufacture of morphine during the last few years, and a considerable quantity from these places has appeared in the market. The photos, which I am passing round, show parcels and bottles of morphine, heroin, and such like, which have been seized by our Customs and indicate also the names of the principal manufacturers and their method of distribution through the parcel post. As much as 3,500 ounces of heroin were seized on one occasion last year in Shanghai and would have been returned to the smugglers if we had not intervened.
11. The fabulous price of $700, equivalent to £210, is charged for one pound of morphine procured wholesale from one leading Japanese drug shop engaged in the illicit traffic.
12. As the laws stand at present, tons of morphine ordered in England could be consigned to Kobe via New York, passed through the customs in bond to San Francisco, dispatched to Kobe, there transhipped in the harbor without entry in the customary

trade returns, taken to Dairen, Tsingtau, etc., and then distributed, for the ruin of millions in China.

13. Korea is rapidly becoming an opium-producing country under Japanese government auspices.

THE HAGUE OPIUM CONVENTION.

A. Signed and Ratified Convention and signed Special Protocol.

1. China
2. Honduras
3. Netherlands
4. Norway
5. United States

B. Signed and Ratified Convention, but not signed Protocol.

1. Belgium
2. Brazil
3. Demark
4. Ecuador
5. Great Britain
6. Guatemala
7. Italy
8. Nicaragua
9. Portugal
10. Siam
11. Spain
12. Sweden
13. Uruguay
14. Venezuela

C. Signed Convention but not Ratified.

1. Argentine
2. Brazil
3. Costa Rica
4. France
5. Haiti
6. Luxemburg
7. Mexico
8. Bolivia
9. Bulgaria
10. Columbia
11. Cuba
12. Dominica
13. Germany
14. Greece
15. Japan
16. Montenegro
17. Panama
18. Paraguay
19. Persia
20. Peru
21. Russia
22. Roumania
23. Salvador
24. Switzerland

D. Not Ratified nor signed Convention.

1. Austria Hungary
2. Servia
3. Turkey.

WU LIEN TEH.

PLAGUE. CHOLERA AND OTHER EPIDEMICS, N. MANCHURIA.

Written for the Customs Decennial Report 1911-1921.

As a result of the severe epidemic of Pneumonic Plague of 1910-11 which overran the whole of Manchuria, Chihli, Shantung and other northern provinces, an International Plague Conference was held at Mukden in April 1911 under the auspices of the then Viceroy Hsi Liang and Special High Commissioner Alfred Sze sent by the then Wai Wu Pu. This Conference was attended by distinguished scientists from eleven countries and presided by Dr. Wu Lien Teh, who had been in supreme charge of the plague operations during the whole time.

One of the principal recommendations of the Conference was the establishment of a permanent anti-plague service with proper isolation hospitals and quarantine stations at strategic centres in Manchuria for dealing with future emergencies. Mr. W. Haines Watson, then Commissioner of Customs at Harbin, consulted the Inspector-General, while Dr. Wu Lien Teh approached the Viceroy of Manchuria and the Wai Chiao Pu with regard to the necessary arrangements. Eventually, in October 1912, the North Manchurian Plague Prevention Service was inaugurated with the following objects:

1. To devise means to prevent the recurrence of Plague in North Manchuria, and to stamp it out on appearance.
2. To give effect to the recommendations of the Mukden Plague Conference, 1911, by making researches into the origin and cause of Pneumonic Plague, and its relation to marmots and other animals.
3. To introduce general sanitary measures in the regions mentioned and, whenever possible, to treat and study local disases.

The funds for the erection and equipment of the necessary hospitals, namely Tls.50,000 for Harbin, Tls.40, 000 for Manchouli and Taheiho, and Tls.20,000 for Sansing and Lahasusu were provided by the Mukden Treasury, while the annual appropriation of Tls.60,000 for upkeep of the Service was met with the consent of the Diplomatic Body in

Peking from the Customs Revenue at Harbin. Dr. Wu Lien Teh was appointed Director and Chief Medical Officer, while the Commissioner of Customs served as Lay Director and Treasurer. The Medical Officers act in addition as Surgeons to the Customs.

The establishment of this chain of hospitals at Harbin, Taheiho Manchouli, Sansing, Lahasusu, and since 1919 at Newchwang, has filled a much-needed gap for the ever-increasing papulation of Manchuria, in that no such facilities for the sick have hitherto been provided by the Government. As showing how active these hospitals have been since their establishment the following figures of general cases treated in each hospital are instructive :

Hospital.	*For years.*	*Number of patients.*
Harbin	1913-1921	101,302
Taheiho	,, ,,	52,940
Sansing	,, ,,	31,304
Lahasusu	,, ,,	12,699
Newchwang	1919-1921	6,455

These do not include 2,000 cholera cases treated in the Harbin Hospital in 1919, of whom over 1,700 recovered and 1,400 plague cases treated in Harbin Hospital in 1921.

Plague. The Plague Prevention Hospitals exist, however, primarily for plague, and it is interesting to note that although the disease is endemic in the regions west of Manchouli known as Transbaikalia and cases of Bubonic Plague are recorded almost yearly in one or more of the small Siberian villages, the pest never crossed into Chinese territory until the autumn of 1920, when it resulted in the second Manchurian Pneumonic Plague epidemic, which, however, thanks to early preventive measures taken, were on a much smaller scale than in the outbreak of 1910-11.

As in the epidemic of ten years ago, it started in the Transbaikal district towards the end of summer, when a Russian family consisting of one woman, a son and two daughters, were reported to have been attacked by the disease in its Bubonic form. With the exception of the man treated at Manchouli Hospital all died. Then two Cossack soldiers living in the same compound took the infection and died, the last on September 20. After this no more was heard until October, when the wife of a Russian guard in charge of the railway bridge at Hailar (117 miles east of Manchouli) died of Bubonic Plague. As a result three out of five sons died : her husband also sickened but recovered. These patients showed buboes in their groin, neck or armpits and had apparently been bitten by infected fleas. Three Chinese soldiers living in the same compound also died of the disease. Owing to the free intercourse between the sick and some outside workmen, the infection was distributed in the city, and efforts at segregation by the medical officers met with only partial success.

Dr. Wu and his staff were on the spot from the beginning and as usual on such occasions met with much opposition from the ignorant classes. The Chief Police Officer Lang, who had been quite enthusiastic helping the medical men, was attacked by the local soldiers who set free nine contacts under observation. Some later deaths at Hailar were traced to these escaped ones, but two reached the coal mines of Dalainor (100 miles away) and spread the infection broadcast among the 6,000 odd coolies living in the semi-under-ground huts of that place.

Manchouli was reinfefcted from Dalainor (17 miles east) and in its turn sent infected persons by rail to Tsitsihar, and later on to Harbin. In this way, the whole line of the Chinese Eastern Railway from Manchouli to Vladivostock (1072 miles) and from Harbin to Changchun (150 miles) received the infection in a greater or less degree.

Fortunately, owing to the early precautions taken by the plague authorities and to the splendid cooperation displayed by the Chinese Eastern and South Manchurian Railways, as well as by most Chinese officials from Governor-General Chang Tso Lin downwards, the epidemic did not reach the colossal dimensions of that of 1910-11. As early as December, an International Plague Committee was formed at Harbin comprising among others, members of the Consular Body, Taoyin, General Chang in charge of the local military forces, foreign merchants, Director at the Chinese Eastern Railway, the chief doctors of the Plague Prevention Service, Municipal Council, Japanese forces, with the Commissioner of Customs, Mr. R. C. L. d'Anjou as Chairman. The duty of this Committee was to help in devising preventive and other measures against a possible epidemic in Harbin and surroundings. Another Committee on similar lines was also formed at Manchouli, with the Senior Customs assistant as Chairman. Possible cases were rigidly controlled, railway wagons were utilised for the segregation of contacts, and passenger traffic between Manchouli and Harbin was stopped from February 1. Daily third class passenger traffic from Harbin to Changchun was limited to only 150 persons, who after inspection at Harbin had to undergo quarantine for a further period of five days at Changchun.

In this way, although Harbin received the main force of the epidemic because of its acessibility from all quarters of hidden cases conveyed by goods' train, by carts and other conveyances, comparatively few cases occurred south of this city. For instance, Shwangchengpu (35 miles south) recorded only 134 deaths as compared with over 4,000 ten years ago; Changchun district claimed only 77 deaths and Mukden only 8 deaths from plague as compared with 5,000 in each city in the previous epidemic. The population of Manchuria had increased from 12 million to 22 millions, while that of Harbin had jumped from 70,000 to 300,000 during the intervening ten years. Whereas at least 50,000 plague deaths were recorded in 1910-11, only 8,500 persons died in the epidemic of 1920-21.

These are satisfactory figures and show what scientific methods of prevention may accomplish in the battle against the most fatal and infectious of all known diseases. It is hoped that the people of China may take this lesson to heart and give every possible support to their trained medical men, who during this epidemic have so creditably and efficiently performed their tasks.

River quartine regulations were enforced by the Customs on the Sungari and Amur from 15th. April, when the rivers opened for navigation. The Medical Officers of the Plague Prevention Service were appointed as Health Officers, and all passengers were examined before being allowed to purchase tickets. Although two suspicious deaths were reported on the first two steamers leaving Harbin, no further accidents occurred, and no plague was reported in any city on the Sungari or Amur. One week after the last case had been registered in Harbin, the quarantine regulations were removed (May 20.).

Out of a total of 8,500 plague deaths recorded, only four places showed a mortality of 1,000 or over, namely, Harbin (3125). Tsitsihar city (1734), Manchouli (1141) and Dalainor (1017). The deaths at Manchouli included 334 Russians and one Japanese, while those at Harbin included 8 Russians and 3 Japanese.

It is interesting to note that beyond the early cases at Hailar, the epidemic was almost purely pneumonic, and less than six bubonic cases were seen altogether at Harbin, Manchouli and Vladivostock. In the last city, 520 deaths from plague were counted beginning with April 9, and ending early in October, 1921. No rat infection was noticed anywhere except at Vladivostock, where five plague rats were dissected.

In addition to the routine work of plague prevention, 8,000 doses of anti-plague vaccine prepared in the new Bacteriological Laboratory of the Harbin Hospital were distributed among the people as well as 60,000 masks for the protection of those coming in contact with suspected individuals.

The Plague Prevention Service has also published, besides annual reports, two bulky volumes in English and Chinese containing medical and scientific articles written for medical journals by members of the staff. The third volume for 1918-22, now in course of preparation, will appear in June 1922, embodying an account of the latest investigations.

A summary of the more important results relating to the Manchurian plague obtained by clinical observation, pathological findings and bacteriological experiments may be mentioned here :—

1. It is probable that, like the epidemic of 1910-11, the outbreak of 1920-21 arose first as an epizootic among the tarabagans or Siberian marmots, whose skins were much sought after by hunters, some of whom received infection through the hands when skinning the carcases and developed *bubonic* plague.
2. Owing to the cold weather and the insanitary way the coolies lived (40 to 60 being herded together in tiers in a closely confined underground space) the few early cases developing secondary lung complications infected others through the breath and thus started the pneumonic plague in an epidemic form.
3. The ignorance of the masses in disbelieving the true microbic nature of the infection, their refusal to report sickness and their escape to new places when attacked were responsible for the infection being carried far and wide.
4. The method of infection was by droplets of infective sputum, that is, patients suffering from cough conveyed the infected matter direct to their neighbors through the respiratory channels, and this was effective within three feet of the patient.
5. After an incubation period of 2-5 days, usually three, headache, slight fever and a quick soft pulse developed as the first signs. This lasted for 24 hours, during which time the patient was non-infectious, so that if the contacts were removed at this time they would probably not catch the disease. The greatest danger was when the patient coughed and lasted until he died, usually within 48 hours after cough and blood spitting appeared. Corpses were not infectious by themselves.
6. The room vacated by the sick and dead was found to be apparently not as infectious as had been supposed. Out of 52 animals exposed to the air of sick rooms

at different times only four young ones died of the plague.

7. Clothes recently taken from the sick or dead were shown by experiments to be infectious and therefore should be burnt with the corpses.
8. Over 400 experiments performed to prove the efficacy of different kinds of antiseptics and disinfectants upon plague sputum showed that the majority of these even in concentrated solutions, had only a slight bactericidal action upon the viscid sputum. The practice of spraying clothes, faces or hands with a weak solution of carbolic acid, as was commonly done during the epidemic, is therefore a fallacious one.
9. With the co-operation of the Russian doctors, the Chinese medical staff has established the presence of bubonic plague among the tarabagans in its natural state, since three dead animals were discovered in September, 1921, showing all positive signs. Further experiments performed upon forty tarabagans at the Harbin Laboratory also proved the fact that these animals could be infected through the respiratory channel, that sick marmots could infect healthy ones kept in the same cage, and that many could retain the disease in a chronic form, while appearing healthy outwardly.
10. The opinion generally held that pneumonic plague is a winter disease and disappears on the approach of warm weather has not proved accurate, since this last epidemic showed itself in Harbin in the first week of February, was most severe in April, and only disappeared towards the end of May. At Vladivostock, the first case was reported on April 9, was most severe in July, and the last case was seen in the first week of October.
11. For personal protection against pneumonic plague, the simple cotton and gauze mask introduced by Dr. Wu Lien Teh in 1910 and recommended by the Mukden Plague Conference has proved to be the most satisfactory.

Cholera. Together with other cities in China, Manchuria was visited by a severe epidemic of Cholera in the summer of 1919. Endemic in Japan, Formosa and the Philippines, this water-borne affection travelled by vessels first to Foochow, then Shanghai and the Yangtse ports and reached Newchwang on July 22. The towns running along the South Manchurian Railway were attacked in rapid succession and the first case in Harbin appeared on 3rd. August. Owing to an unusually dry summer, flies preponderated and were largely responsible for conveying infection from infected stools to food and fruit, probably through the hairs of their limbs. Within six weeks, over 13,000 cases had been reported in Harbin alone, of which only 1,962 reached the hospital and were treated. With the aid of hypertonic saline solutions, the staff of the Plague Prevention Service was able to cure 86 percent of the cases, admittedly a splendid record. Unlike pneumonic plague, Cholera, however severe, lends itself to cure. As a rule, two to three litres of the following solution wre injected into the brachial viens, and repeated once or twice if necessary :—

Sodium Choloride	gr.	120	(8 grammes).
Calcium Chloride	gr.	4	(0.25 ,,).
Potassium Chloride	gr.	6	(0.40 ,,).
Distilled water	pint	1	(568 c.c.).

Cholera cases were also treated at Sansing and Taheiho, but the disease was not severe at these places.

Influenza. China also received its toll from the deadly pandemic of Influenza which spread over the world in 1918, killing in India alone 5 million, in America half a million, and other countries three million people. About 10 to 20 per cent of the cases developed pneumonia and gave rise to the theory in many places that this was the pneumonic plague or Black Death in a new form. However, the causes of the two diseases were quite different, the plague being due to an easily-seen bipolar stained organism under the microscope, while the germ of the flu was not certain. As compared with other countries, China did not suffer very badly from the Influenza, having lost between two and three hundred thousand out of her large population.

Typhus. Owing to the large influx of poor refugees from Russia and Siberia as a result of Bolshevik activities, large numbers of Typhus cases entered Manchuria and gave considerable anxiety to the sanitary authorities. The outbreak was most serious in the winter of 1918. At one time the Russian Hospitals were practically filled with Typhus cases. Even during the Cholera epidemic of 1919 several cases of Typhus were encountered among the Chinese. The infection did not appear, however, to be as serious among Chinese as among white people.

Typhoid, Small-pox, Dysentery and other kinds of bowel diseases were not unusually prevalent,

THE TEMPLE OF MEDICINE IN PEKING.

Reprinted from the National Med. Jl. of China, Vol. V. 1919.

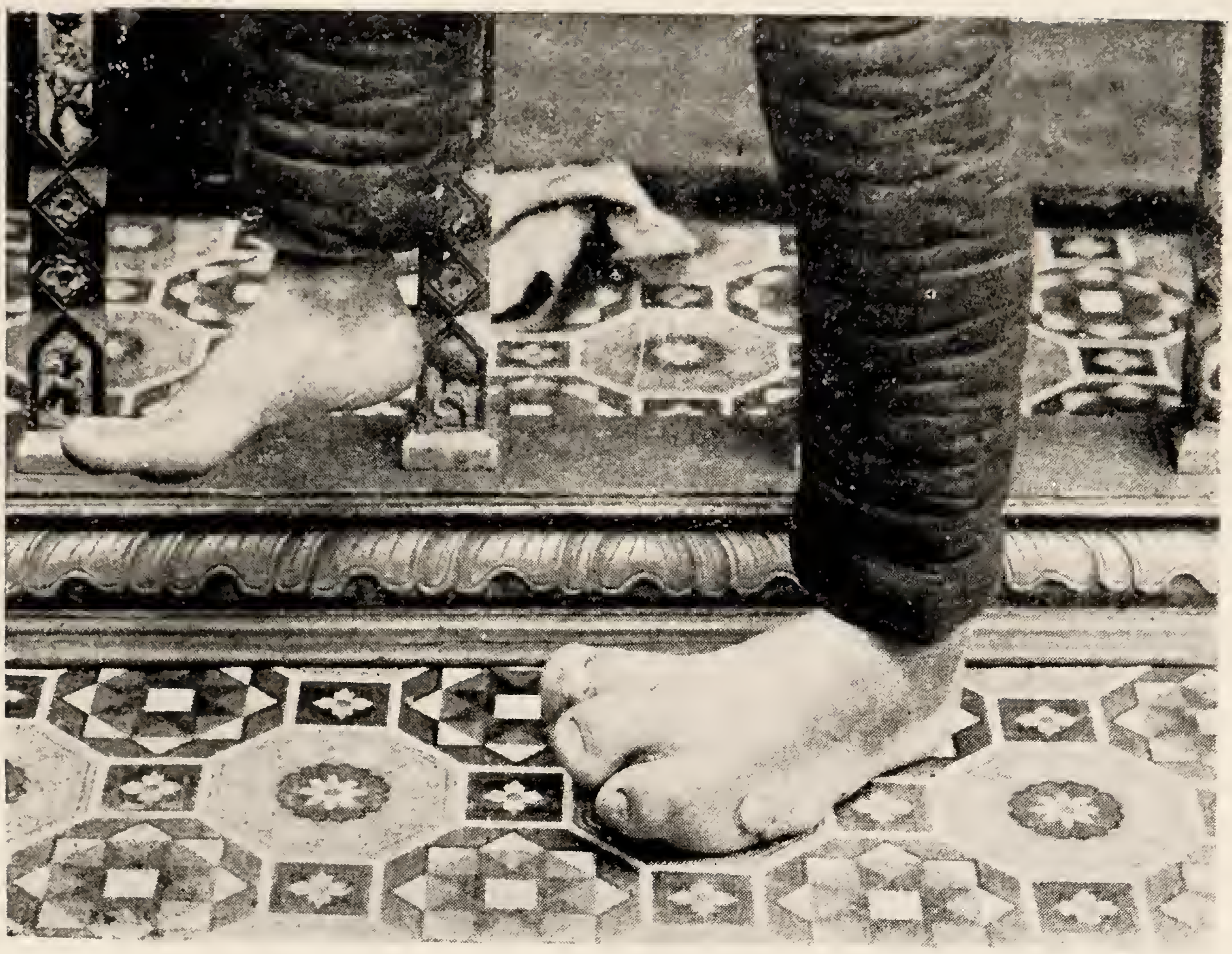
In the northeast part of Peking, just outside the famous Chao Yang Gate, through which the main Allied troops entered in 1900 for the relief of the Legations, there is situated a large temple dedicated to the sacred memory of the earlier emperors of the Ch'ing Dynasty. It covers many acres of land, and contains innumerable shrines and idols, which are worshipped by thousands of people, especially women, on the first and fifteenth of every month (lunar calendar). This temple is called the *tung yueh miao* (東嶽廟) or eastern mountain temple.

Of the shrines, three are particularly interesting to seekers of medical lore in China; namely,

(a) *The Bronze Horse.* This is made throughout of bronze, perfectly shaped, the size of an average Mongolian pony, and resting on a marble pedestal. It is supposed to have the power of curing sickness arising from any part of the human body, as soon as that particular part of the bronze pony is touched by the worshipper. For instance, if the complaint be rheumatism of the knee, the patient has only to rub his knee against the knee of the pony, and the pain will disappear; if he suffers from ophthalmia he needs only rub his eyes against the eye of the bronze statue, and they will get well, and so on. Some women go so far as to touch with their fingers the genital organs of the statue in order to obtain relief from uterine pain or even to beget children. The eyes, knees, mouth, and scrotum of this interesting pony show marked signs of rubbing by their polished appearance.

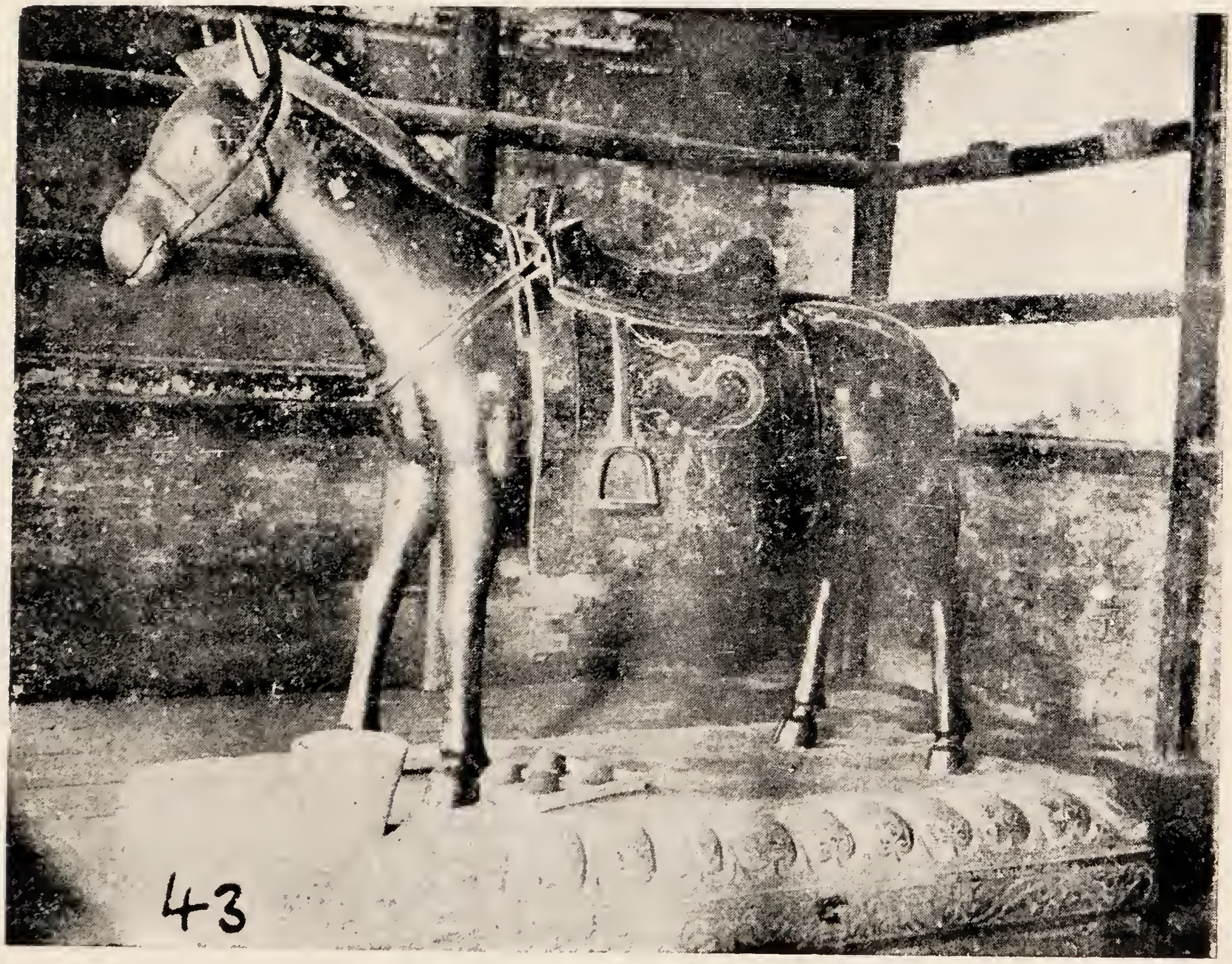
Adjoining this bronze pony is one similar in size, made of wood and painted to look like a white mare. The keepers of the temple assert that the original one was also of bronze which in a fit of anger had escaped from the temple and fled into the province of Honan. The real truth probably is that it was removed during the occupation of the Allied troops of Peking, as in the case of the figure of acupuncture in the temple of the College of Imperial Physicians (see earlier number of *National Medical Journal*).

(b) *The Shrine or Proclivity.* This is situated in the front of courtyard, and contains two enormous figures-male



Congenital hypertrophied left foot. Three large toes were removed to enable shoe to be worn.

先天奇形異足示三趾割去使便穿鞋



Brass horse in Tung Yueh Temple, Peking.

北京東嶽廟之銅馬

and female—in front of which are placed over a dozen clay models of babies looking very happy. On either side of the altar, but still inside the shrine, are life-sized idols of nurses, servants, chair bearers, and children showing different degrees of happiness and luxury. The walls abound in inscriptions lauding the need and uses of children. Some such inscriptions are quoted below:

廣嗣神靈
保我赤子
保佑子孫
恩慈嗣續

(c) *The Shrine of Control of Sickness.* This is situated a few yards from the shrine of proclivity. Some twenty figures are placed here representing certain common diseases, and are presided over by a central figure. The gateway is decorated with two beautiful wooden scrolls extolling the greatness of the spirit residing therein.

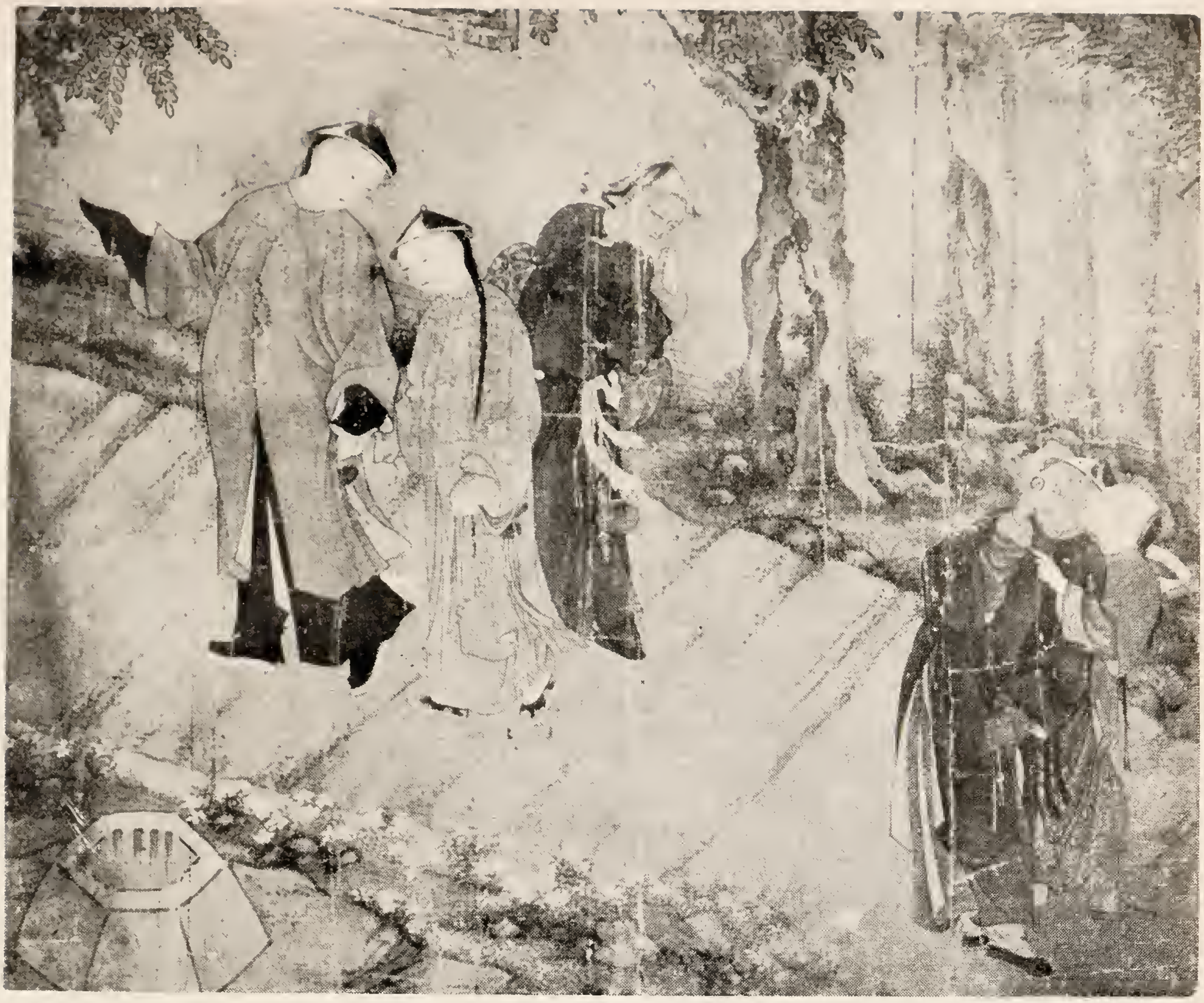
A GROUP OF EUNUCHS IN A CHINESE IMPERIAL PALACE.

(From an old Chinese Painting in the writer's possession).

Reprinted from the National Med. Jl. of China, Vol. VI. 1920

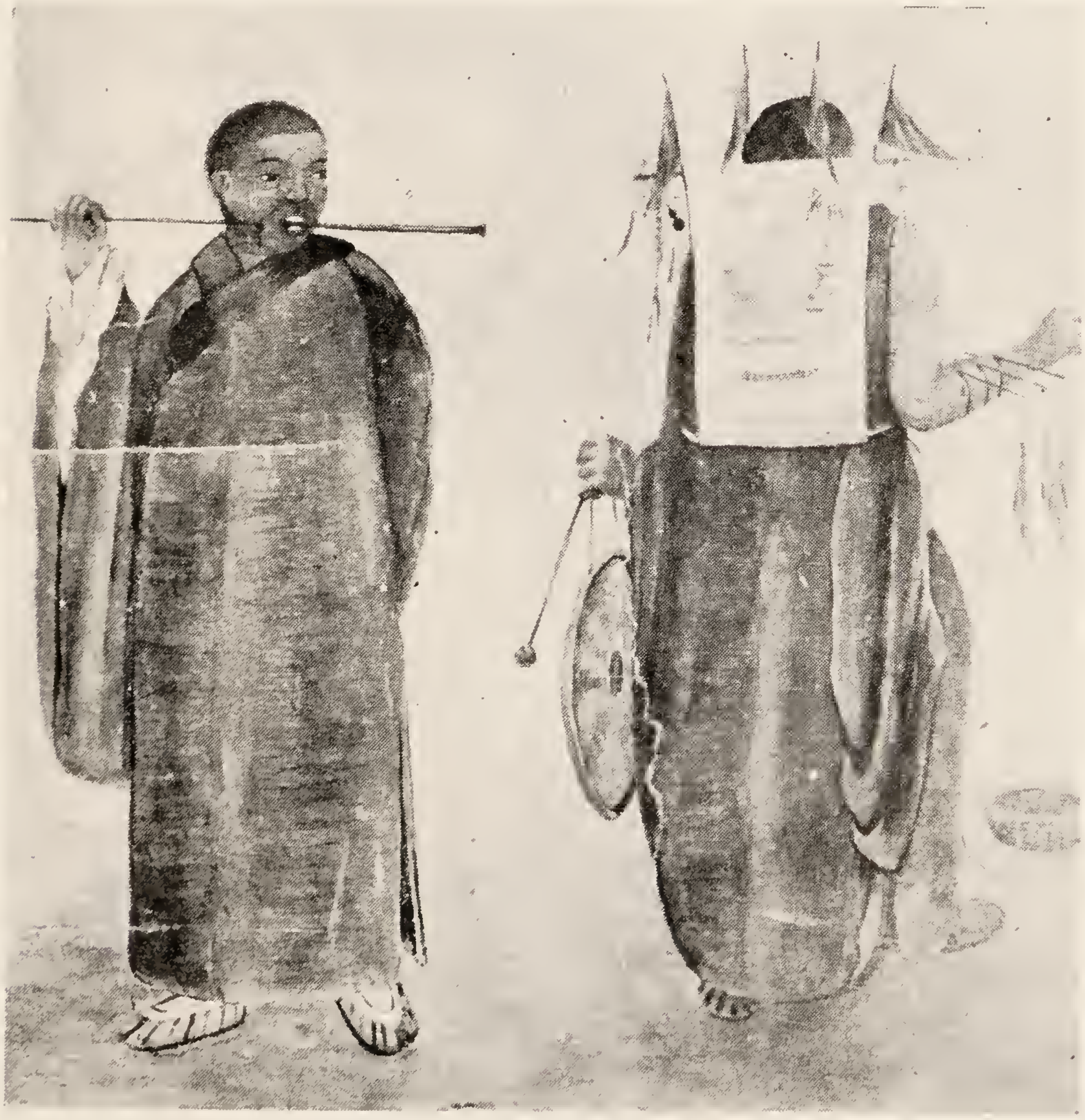
It is a well-known fact that the only male domestic servants allowed constantly in the Imperial Palace during the Manchu regime were the eunuchs (太監). Their use in China seems to have dated from the Chou dynasty (1125-250 B.C.), and succeeding emperors and princes kept up the habit. These eunuchs were recruited mostly from the province of Chihli, particularly the district of Hochienfu (河間府), where regular barbers used to undertake the task of removing the penis, scrotum, and contents of young boys destined for the Imperial household. Sometimes this operation was performed when the boy was under ten years of age, but quite often youths during the adolescent stage were subjected to it, and not rarely have I met old eunuchs with one or more wives and a family of sons and grandchildren, who maintain that their genital organs were removed only after they had married and got families.

The operation usually consists of one clean sweep of a sharp razor-like knife across the genital organs from below upwards, removing the scrotum, both testes, vasa deferentia and adjoining tissues, and the exposed part of the penis at one and the same time. A large open wound is thus produced and owing to sepsis may take months to heal up. The usual sequela is stricture of the urethra owing to its retraction, which inflicts untold suffering upon the victim and may cause permanent cystitis. Apart from the unnatural effects produced by the loss of internal secretions (hormones) from the generative glands upon the whole human system, the constant suffering from incontinence, fever, and stricture changes the individual's attitude toward life, makes him a secretive and revengeful intriguer, and accounts for the degrading and brutal tendencies which marked the political history of China wherever eunuchs had risen to assume responsible parts in the government of the country. Since the institution of the Republic, no fresh eunuchs have been created and the old ones are fast dying out.



Old Painting of a Scene in the Imperial Palace, Peking, showing Eunuch life

古畫示皇宮內太監之生活



Picture of self-mutilation by street priests on cheek and arm.

示個人殘害頰臂之丐

In the above photo taken from an original old Chinese painting in the writer's possession, an interesting scene inside the Palace surrounded by aged pine trees with a well in the foreground is shown. A young eunuch, evidently a recruit—shy and suffering—is being conducted by a friendly eunuch toward quarters assigned to him. Standing just behind is another member of the fraternity, only much older and more experienced, returning in characteristic English schoolboy fashion complimentary remarks made by a passing *roue* of an eunuch, so evidently the villain of the piece. This old *roue* has a young naughty follower, who is humming confidential words into his ear, while his left forefinger is pointing to the discomfited recruit. The fact that the old eunuch is actually applying a framed monocle to his right eye is most interesting and shows that such fashion is not confined to aristocratic English colonels of modern times!

The whole painting, besides its intrinsic interest, is also valuable as a fine sample of Chinese art.

WU LIEN TEH.

A PICTURE ILLUSTRATING SELF-MUTILATION.

Reprinted from the National Med. Jl. of China, Vol. VI. 1920

The accompanying street scene, which a Chinese artist has depicted in a painting, used to be more frequently met with in Chinese cities than at the present day. On the right is a man attired in the robes of a monk with the left arm hidden from view but with the right raised to balance a long three-foot iron needle (rod will be more accurate) which is smaller and sharper at one end. This rod has been made to pierce the right side of the man's cheek by first inserting it into the mouth and then allowing it to penetrate the thickness of the buccal portion of the face. Blood may be seen oozing from the wound.

The other man on the right side of the picture is even more weirdly dressed. His right arm is exposed up to the shoulder, and three large needless may be seen passing from without inwards across the dorsum of the forearm, each needle being five inches in length and having a yellow rag attached to the blunt end so as to produce greater dramatic effect from a distance. Blood may be seen oozing from the points on the arm through which the needles have passed. On the left wrist hangs a gong which is sounded by the man holding the sounder in such a way that a noise is made by the gong swinging outward to meet the knob of the sounder. On the back of the same man is hung a placard with overhanging flags containing some superstitious sayings in addition to a rough drawing of some begging Buddha. Attached to his clothes in front is a straw basket for collecting coppers thrown out by a sympathizing public.

Close investigation usually reveals the fact that these men have practiced this trick for years and that the holes through which the iron rod and needles pass are chronic ones made in younger years like the holes in the ears for the reception of ladies' ornaments. The trickling blood is not fresh human blood, but merely that from a recently killed chicken painted on when occasion demands it! When these beggars reach their abodes, the needles are pulled out, the chicken's blood is washed away, and they can go out to have a good time as ordinary citizens. When fresh funds are needed, the monk's dress is put on, the needles and rods are inserted, and a neighbour's chicken's blood is dabbed on wherever required,, and a fresh locality is chosen for their peregrinations. A very simple profession, easier than that of Sherlock Holmes's mysterious man, who is beggar in the day-time and a gentleman of leisure in the evening!

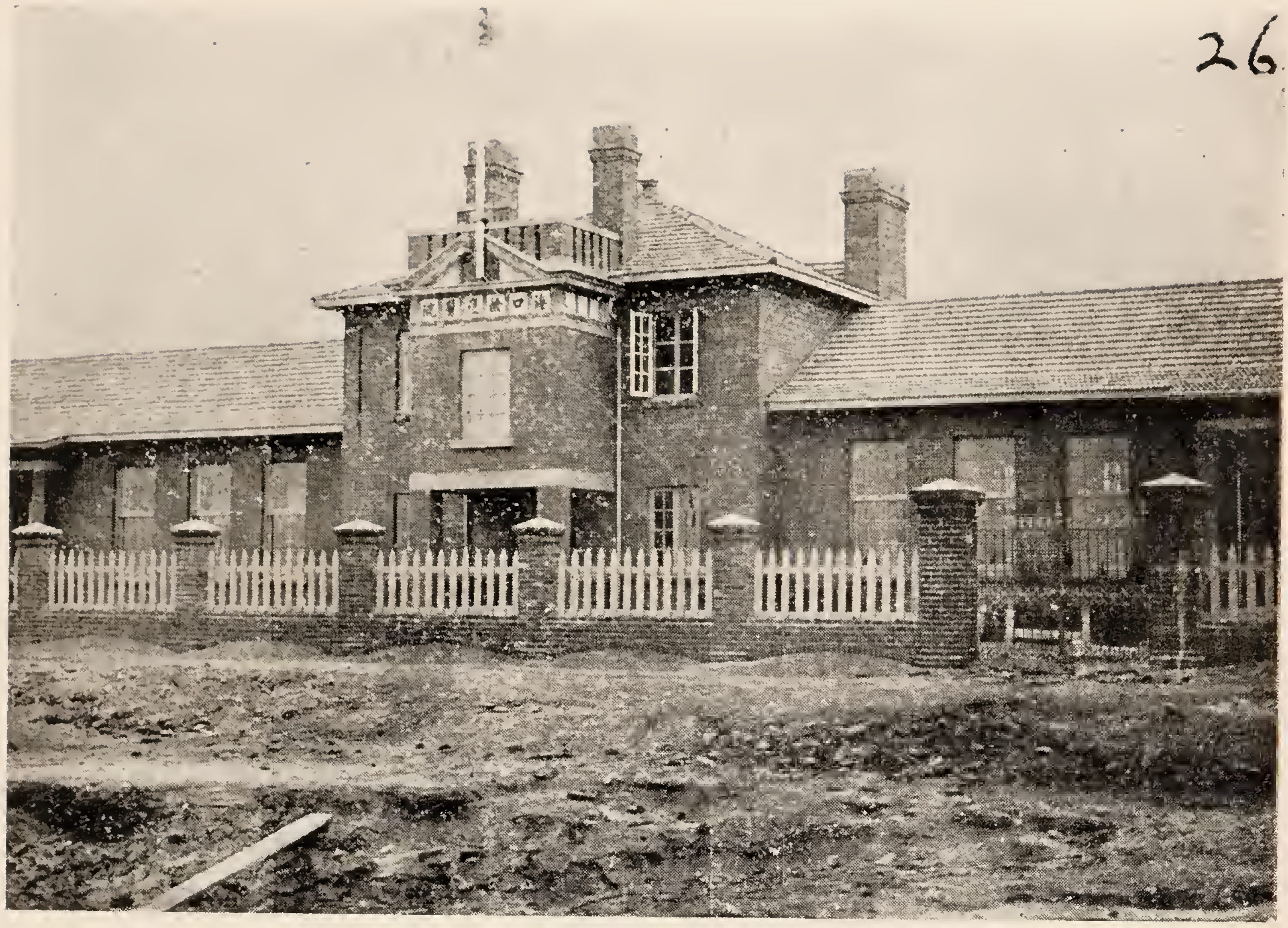
Wu Lien Teh.

NEW QUARANTINE HOSPITAL AT NEWCHWANG.

Reprinted from the National Med. Jl. of China, Vol. V. No. 3. 1920.

The New Quarantine Hospital at Newchwang (Yingkow) established by the Chinese Government, which had been in course of construction since the summer of 1919, was formally opened on July 10, 1920. It is situated on the southern bank of the river Liao and adjoins the West River Customs. Exactly opposite on the northern side of the river is the terminus of the Koupangtzu-Yingkow Branch of the Peking Mukden Railway. All vessels entering the port passes the new hospital and in case of epidemic or suspicious sickness on board will be examined by the health officers who are on the regular staff of the hospital. The need of such a hospital has been felt for a long time both by the government and the commercial classes of all nationalities residing in the port, and it has taken four full years to accomplish the fact. It may be remembered that last year's (1919) epidemic of cholera from the south entered Manchuria *via* Newchwang and caused wide havoc among the Russian, Chinese, and Japanese population in various parts of the province-, including Mukden, Dairen, Harbin, Kirin, Liaoyang, Changchun. Had this city possessed a proper hospital supervised by a competent medical staff thousands of lives would have been saved. The approach of another dry summer and the fly season entails a serious responsibility upon the authorities, who should use all attempts to prevent a recurrence of another cholera epidemic similar to that of last year. The new Quarantine Hospital will partially fulfill this function by providing the necessary medical staff for watching the situation, examining steamers and other vessels in time of need, and providing facilities for isolating and treating the sick.

The new buildings of the hospital consist of a general block, a disinfectant block, and a contagious block. The general block is an imposing red building finished with cement lining and measures 162 feet from east to west with two wings each 80 feet deep. There are two front entrances, the east one for private and urgent cases and the west for ordinary out-patients. On either side of the main entrance are situated the main general wards with attached nurse's room, laboratory, lavatories and bathroom. Each main ward accommodates at least ten beds. On the east wing are placed the main operating room having a wainscoting of white glazed



26

Main block of New Quarantine Hospital, Newchwang, opened 1920.

牛 莊 隔 離 所 之 正 面 圖

(一九二零年成立)

27

Shanbaikwan plague blocks erected in 1911.

山 海 關 隔 離 所

(一九一一年成立)

tiles, anasthetic and sterlizing rooms, private wards for men and women with special bathrooms and lavatories. In the west wing the out-patient department, waiting room, doctor's consulting room, bandage room, dispensary with store, and a fine bacteriological laboratory are seen. A central staircase leads to the quarters of the medical officers, who have their own sitting room, pantry, and kitchen besides bedrooms, all furnished by the hospital.

From the two back entrances, gravel paths lead the visitor to the main kitchen, the attendants' quarters containing bedrooms, the dining room, and the shower bathroom, while another path leads to the disinfection rooms, in which a large high-pressure English-made steam sterilizer capable of disinfecting beddings and mattresses as well as ordinary clothes will be installed. Adjoining this is the laundry made, as far as possible, to serve sanitary needs.

The third block contains isolated rooms with cement floorings for actual contagious cases. There is a spacious open veranda, facing south, along which additional beds may be placed in case of emergency. In this block there are special nurses' rooms, bathrooms and lavatories, and linen rooms.

The whole compound of the hospital occupies about three and a half acres of ground and is enclosed by a brick wall with ornamental wooden railings. The Inspector General of Manchuria, Chang Tso-lin, has shown the greatest interest in this hospital and donated $7,000 for purchase of the land. The last Commissioner of Customs, Mr. C. E. S. Wakefield, worked very hard during his four years in this port to urge the need of this quarantine hospital upon his immediate superior and the local authorities. The hospital is managed by a Board of Directors consisting of the Taoyin of the Newchwang district, Dr. Wu Lien Teh (Director and Chief Medical Officer of the Manchurian Plague Prevention Service) and the Commissioner of Customs. The medical staff consists of Dr. Wu Lien Teh (Chief Medical Officer), Dr. W. Phillips, F.R.C.S. Eng. (Port Health Officer), and Dr. E. B. Young (Health Officer and Senior Resident Medical Officer).

The inauguration ceremony was attended by over two hundred leading members of the Newchwang community as well as by representatives from the Governor-General Chang Tso Lin, Kwantung Governor Yamada, Dr. Tsurumi, Dr. Murata, and others. A long period of usefulness awaits this latest addition to the series of hospitals comprising the Manchurian Plague Prevention Service.

EDWARD S. YOUNG, M.D. (DETROIT)
Senr. Resident Med. Off.

SOME PROBLEMS BEFORE THE MEDICAL PROFESSION IN CHINA.

Presidential Address, National Med.-Assoc., delivered in Canton, Jan. 25, 1917.

I appreciate highly the honour which has been shown me in being asked to deliver the first address before the Joint Conference of the China Medical Missionary Association and the National Medical Association of China. Whether this experiment will be successful or not depends much upon the results of the present meeting. I feel sure that the many delegates who, like myself, are visitors to this interesting city, owe a debt of gratitude to our Canton colleagues for the great care they have taken in providing us with a very full programme both of work and entertainment. I must not forget the kindness of His Excellency, the Civil Governor, in taking such a keen interest in our proceedings.

I have chosen as subject for my address "Some Problems before the Medical Profession of China." It is generally acknowledged in western countries that medicine, beginning as an art in the days of Hippocrates, has in the course of centuries become a very complicated science, in which all the latest inventions of the age are brought into play, wherever possible, for the treatment and prevention of disease. However much progress may have been made, it is not forgotten that the medical profession is a humane one; that is exists primarily for the relief of suffering; and that it binds its members, with or without the intervention of the state, to certain ethics or laws of proper conduct which they are warned not to break on pain of being expelled from the profession. In these laws, public advertising and the booming or sale of quack medicines are two important items noted down for special condemnation. As medicine passes from the prescribing to the preventive stage, and becomes freed, as it ought to be, from the mystery it has for centuries been shrouded in, it is hoped that a proper conception of the aims and requirements of the profession may lead to a clearer understanding between various classes of medical men, between physician and patient, and between one community and another.

The second problem which appears to me as requiring urgent solution is the standard of medical colleges in China. Let me acknowledge at the beginning the debt which medical science in this country owes to the splendid pioneer work of medical missionaries. From the time the first hospital was established in Canton in 1838, their labors have been unceasing, and the success achieved in spite of the conservatism of the people has been very great. Owing, however, to the absence of a common policy, various schools have in the past adopted different schedules of study, so that their standards vary greatly. As a result, the graduates turned out of these institutions possess mixed ideas of their duties and responsibilities. Fully qualified physicians, trained nurses, semi-educated students and even dispensers are confounded by the public under the name of "doctor." To add to the confusion, the Central Government and provincial authorities set up standards of their own, each independent of the other, and being unguided by expert advice make irreparable mistakes. In other words, we are experiencing in China the same difficulties which existed in America for over a half century but which, thanks fortunately to the investigations of Abraham Flexner and the leadership of the American Medical Association, have been settled within the last few years. In China, owing to the lack of leadership by the Central Government or some such a body as a Central Medical Council with official status, the medical profession is still running along disjointed lines. It is my earnest hope that these two sister Associations of ours, which comprise practically all the leading practitioners of China, will unite in tackling this difficult problem. For, however necessary modern medicine may be to this country, I would rather see a few well qualified men and women with high ideals than a great many poorly qualified ones with indifferent ambitions. For the one makes for progress, whilst the other leads to stagnation, if not retrogression. I believe the time is ripe for us to show a united front and to solve the many problems which have awaited solution. We must first put our house in order and carry into effect the resolutions passed in previous years. Let us enumerate all the medical institutions in China, boldly classify them under A, B and C and submit our findings to the proper authorities. Let us consider under the essentials of an efficient medical college, a good preliminary education, well-quipped laboratories for the teaching of chemistry, biology, up-to date hospitals for clinical instruction, and sufficient teachers. Let us lay stress upon the ethics of the medical profession and modify them, wherever necessary, to meet the special conditions of China. Above all, let us pay more attention to the teaching of public health, for the medical officers of health of the future will exercise in China, as elsewhere, more influence in shaping the destinies of the profession and indeed of the country they serve than any other body of men. We have watched with interest and sympathy the activities of the Rockefeller Foundation in China during the last two years, especially in bringing about a more systematic reconstruction of the principal medical colleges. In this respect, I am delighted with the prospect of hearing at this Conference from the Resident Director himself (Mr. Roger S. Greene) an account of the aims and objects of that great Foundation in China.

For some years I have advocated the establishment of a Central Medical Council in Peking with functions similar to those of the General Medical Council of Great Britain and Ireland. This Council should consist of an official of the Board of Education and also one representative appointed by each of the medical bodies or institutions approved by the Board of Education. This Council should include among its duties:—

1. The decision of the language or languages to be recognized in the teaching of medical students.
2. The fixation of a minimum standard of general education required of students before entering upon medical studies.
3. The fixation of a minimum medical curriculum.
4. The supervision of examinations, including, if required, the functions of a Central Examining Board for the whole country.
5. The recognition of medical schools other than those already recognized by the Board of Education.
6. The recognition of hospitals where students may obtain their clinical teaching.
7. The drawing up of laws and regulations affecting the medical and pharmaceutical professions in China and their enforcement.
8. The issuing of a medical register containing the names of all those qualified to practise medicine in China, and also of medical students.
9. The adoption of a general nomenclature of medical terms in Chinese.

The National Medical Association forwarded a petition embodying the above proposals to the Board of Education last year, but owing to the political troubles no decision has been taken by the Central Government. I entertain strong hopes, however, that by the time our next Conference meets, this Central Medical Council will have been formed.

The future before the female medical practitioners of China is very bright. Owing to a somewhat different code of ethics governing Chinese social life, the women of the country, particularly in the south, seem to prefer being attended by their own sex. Our two Associations should encourage rather than discourage this partiality for there is no doubt that much of the misery, lack of hygiene and enormous infantile mortality among rich and poor alike may be traced to the ignorance of the womenfolk. The sanitary conscience of the women requires as much awakening as that of the men, and this will be more successful in the hands of women who have received education and are guided by doctors of the same sex.

While on this subject I must not forget to maintain the need of properly trained women nurses in our medical institutions. There seems to be a prevailing opinion that as a rule women should not be employed as nurses in men's wards. They have been successful, in fact indispensable, in Europe, America and even Japan, where the female sex occupies a more subordinate position socially than she does in China. Why the line should be drawn in the case of China I do not know, beyond the two paradoxical reasons that women are irreponsible when illiterate and proud when educated. I feel quite convinced that if my colleagues attempt the experiment they will find general nursing by women as attainable as the sanction of dissection by the Government.

Before I conclude I wish with your permission to accede to the request of our colleagues in Canton and refer to the local medical situation . As is well known, the people of Kwangtung are more progressive and more prosperous than those of any other province. As in the case of Manchester of England, you may say that what Canton thinks to-day the rest of China thinks to-morrow. It was in Canton that the first western hospital was established in China, and there are perhaps more men and women medical practitioners in this province than in any other. Of these schools, the Kung Yee has a full complement of teachers. The necessary hospital accommodation will be provided for in the new building, the foundation stone of which we shall help to lay next Saturday. The other two leading medical colleges in this city are the Kwong Wah and the Kung Li (Government) both of which have special features of their own. I need not mention the renowned Hackett Medical College for Women, which stands in a class by itself. But what I would like to lay emphasis upon is the urgent need of union, for by that means you will practise economy, increase efficiency, and build a higher reputation for Kwangtung medical science. Surely with a little give and take, a common way will be found by which the Kung Yee, Kung Li and Kwang \ Medical Colleges will be able to amalgamate and found the

Kwangtung Union Medical College. As soon as you do that the smaller ones will fall into line and send their students to it. Continue to teach medicine in Chinese as you have hitherto done, for instruction in English has already been provided for in the medical department of Hongkong University. You are fortunate in having as Civil Governor of this Province (H.E. Chu Ching Lan) perhaps the most go-ahead and democratic high official in China, who is keenly alive to the needs of the day. Whatever reasonable proposal you may make to him unitedly on this subject, will I am sure be favourably considered, as has been shown by his handsome constribution of $10,000 to the Kung Li Hospital and a subscription of $500 towards the fund of the Public Health campaign.

As the future of this great land as a strong and independent country depends largely upon the united forces of its people, so the progress of medical science in China rests mainly upon its medical profession. We should take the lead and hand of good fellowship which has been so willingly offered to us for over a decade by our missionary colleagues, but the rate of progress will depend largely upon our own efforts. To succeed in this, as in all other spheres of national work, faith, unity and co-operation are of the utmost importance.

WU LIEN TEH.

SCIENTIFIC MEDICINE AND PUBLIC HEALTH.

Address delivered before Chinese Students in America 1920.

This Convocation, it seems to me, is in itself a testimony of our country's ardent desire for progress in scientific attainments. You and I are here as her representatives in America, this vast field of scientific endeavour, that we may become properly trained to assist in solving some of China's important problems of the future. This morning, in the time allotted to me, I wish particularly to emphasize a distinct lack of enthusiasm shown by our countrymen toward the kind of progress which appeals to me as of extreme importance—I refer to the advancement of Medical Science and Public Health. Nor can it be said that China's delinquency is unique. A mere superficial acquaintance with medical history teaches us the difficuly which has always been encountered in combating superstition and ignorance—two of the greatest foes of medical achievement. In order to realize the prime importance of this subject, we have only to recall the familar quotation,—"The health of the people is the power of a nation." One of England's great prime ministers, Disraeli, said half a century ago that the care of public health is the first duty of the statesman. And recently England's present premier has struck the same note by uttering the following significant statement,—"You cannot have an A1 empire with a C3 population." And it is to you, most distinguished and highly educated of my brothers and sisters, that I choose to bring my message this morning, in the hope that you may all play an active part in fostering science and truth while at the same time doing away with superstition and quackery.

In carrying out any progressive campaign, we are at once faced with the problem of educating the people. Advancement in medicine goes on hand in hand with advancement in general education. It is just this requisite for the march of progress that is the most difficult to fulfill, but it is one with which men like you and I shall have to deal with constantly when we again return home. It is the part of this particular programme in which I am very desirous of enlisting your sympathies. You, and you only, can thus educate—talk of it in family circles, write of it to your friends, do all you can at least to start this transformation. I believe that time is ripe, yes, overripe, for such a change. However crude and seemingly aimless our first efforts may be, let us strive manfully forward, realizing that we are following the footsteps of our Western prodecessors in the field, who, after passing through this unsatisfactory state years ago, have now finally reached a truly glorious state of success. And I speak thus, fully knowing that our Western neighbours have still much greater perfection in store for them in the future.

In our country, from a medical standpoint, a state of affairs exists which can well be compared with that of our Western friends a few centuries ago. At best, our doctors are for the most part guessing both as to the diagnosis and treatment of disease. sThe late Li Hung Chang, when asked why he took foreign medicine, said to a friend: "Well, my belief in Western medicine is this: Take for example, a portrait painting by our best native artists cannot be compared with that produced by foreign artists both in ideal and likeness—not to mention foreign photography which in an instant reproduces the perfect likeness of its object. So I do not believe that we can cope with foreign countries in medical science." Thus he (Li Hung Chang) was the first man to inaugurate the earliest Government Medical School, now called the Navy Medical School of Tientsin.

What do I mean by the term "scientific medicine"? It is simply this—a practice found on truth, laboratory experiments, and demonstration. A truth based on scientific principles, which can be seen with one's own eyes, is bound to be both permanent and helpful. This, and this only, will stand the test of time, because it is built upon a firm rock. My use of term "scientific medicine" may be construed in a most inclusive sense. I mean both curing or therapeutic practice (usually termed "medicine and surgery") and also a more recent and equally important adjunct, preventive practice, which is termed "preventive medicine or public health."

Let us first discuss the aims of "scientific medicine" considered in the first sense. These aims are twofold; viz., diagnosis and treatment. By diagnosis I mean the determination of what is the trouble with the patient himself. If such a question as this is to be settled, then the logical step to take is to see what is abnormal with the patient. There is no guess, neither is there any superstition; it is a collection of facts based upon scientific research. A physician, however, must have a thorough knowledge of three things: (1) The structure of the human body and its functions, viz., of anatomy, physiology, and physiological chemistry. (2) He must study disease and its causes and nature, so that he can tell, for example, whether the case is a disease of the blood or a disease due to functional disturbance of a certain organ. (3) He must be conversant with and know how to employ therapeutic agents, both preventive and curative, that he has at his disposal, including not only drugs but also other means and forces. However fundamental the above-mentioned subjects may be in medical science they are unknown to our native doctors. Therefore, with your permission, I will say, that to expect a native physician to tell the true case of disease is just as hopeless as to ask a native mason to build a huge bridge, such as the Manhattan Bridge of New York at the mouth of the Yangtse River.

Let us now turn to a consideration of the second part of scientific medicine—preventive medicine. Preventive medicine is sometimes called public health, inasmuch as the preservation and promotion of health results in the prevention of disease. Even the most ignorant persons have a fearful dread of explosives and firearms, but just how many of our average Chinese citizens are aware of the presence of even more deadly weapons of human extermination—the pathogenic or disease—producing germs or microbes. In our country hygiene receives very little attention, although matters relating to public health were mentioned as early as the Chow dynasty, about 1000 B.C.; consequently, infectious diseases have been rampant and have cost the loss of innumerable lives. The terrible pneumonic plague epidemic of Manchuria in the latter part of 1910, together with its quick suppression by energetic scientific methods, which aroused the world's attention, is still fresh in our minds. In America, the value of preventive medicine is just beginning to be fully realized. Despite the fact that we have all known for ages that it is far better from the standpoint of health to prevent disease than to cure it, the practice of preventive medicine has unfortunately lagged behind much in our country.

Times prevents me from going into detail in describing the various activities incorporated under a public health system of management. But it is of value to mention that marked improvement has been accomplished in the standard of health by our Western friends, the enforcement of laws, in hygiene of the household , of the school, of the army and navy, and of the community. While public health authorities of Western countries are employing their utmost endeavors to secure the enactment and enforcement of the sanitary laws and regulations, a large part of their work and success lies in the enlightenment and education of the people in all matters pertaining to public health. Through the use of literature, lectures, exhibits and moving pictures, some of the most efficient fights against the disease in the United

States and European countries have been carried out. Besides, we find there is a sanitary division whose duty is to supervise water supplies, food supplies, sewage disposal plants, etc. Another extremely important department is that of epidemiology. This means study of epidemics. Just as a fireman fights the spread of a fire, so the epidemiologist fights the spread of infectious diseases. Among the weapons which an expert of this profession employs in his combat we may mention (1) hospitalization and isolation; (2) improving the sanitary conditions of the infected communities, if such improvement is necessary; (3) a statistical study of the distribution of the cases of the disease, which data often give a clue as to the cause of the trouble.

Lastly, allow me to mention only one more of the divisions of preventive medicine—that is, the statistical side of the work. Such a department is often called the division of vital statistics. By such a means the public health officials are able to measure the efficiency and progress of their work. To put the same thing in the words of a doctor, one is able to feet the pulse of a nation or community. Such a question as "Are not too many of our babies dying?" or "How large is our death rate from typhoid fever?" is answered at once through this method of research. And if the death rate is such in any way, then steps are immediately taken by the authorized persons to do everything possible to diminish this unnecessary waste of lives. With our increasing knowledge of modern medicine, many diseases are now known to be preventable and subject to administrative control. Thus, cholera, malaria, plague, small-pox, typhoid fever, and yellow fever, are no longer a serious menace to civilized countries, since their nature and mode of transmission are thoroughly understood, and preventive measures are applied. Three centuries ago, the annual death rate of London was more than 80 per 1,000 of the population; now it is 13. In England the death rate from tuberculosis (consumption) has been reduced by one half during the last fifty years; and since 1900 our Western neighbors have reduced their infant death rate more than a third. The general death rate of the United States has fallen from 19 per 1,000 in 1890 to 16 per 1,000 in 1905 and this reduction, with an estimated population of 80 millions, would represent a saving of 272,000 lives annually. According to my experience as health officer in Manchuria, our annual death rate during the last few years was more than 40.

The following table gives us a comparison of death rate of some Western countries:

Countries.	Death rate from all cases per 1,000 of the population. Annual average.							
	1881–1885	1886–1290	1891–1895	1896–1900	1901–1905	1906–1910	1909	1910
U.S.A	19.1	?	?	17.8	16.2	15.1	14.4	15.
Austria	30.1	28.9	27.9	25.6	24.2	22.3	22.9	21.
Belgium	20.6	20.2	20.1	18.1	17.	?	15.8	?
Chile	26.9	35.2	32.6	28.8	30.2	31.2	31.5	82.5
Denmark	18.4	18.4	18.6	16.4	14.8	13.7	13.2	12.9
England	19.4	18.4	18.7	17.7	16.	14.7	14.6	13.5
France..................	25.3	20.	23.3	20.7	19.6	19.2	19.2	17.9
Prussia..................	25.	24.	22.8	21.	19.	17.3	17.	16.
Russia (Europe) ...	25.4	33.2	28.9	31.9	30.9	?	?	?
Serbia	24.5	25.9	28.9	24.8	22.	?	29.	?
Spain	32.6	80.9	30.1	28.8	26.	24.	24.	23.3

Here is another table to show the comparative fatalities from certain infectious diseases of the U. S. A. for four periods from 1900 to 1918:

Death rate per 100,000 of the population

Disease.	*1900.*	*1905.*	*1915.*	*1918.*
Typhoid fever	35.9	27.8	12.4	12.0
Scarlet fever	10.0	6.7	3.6	8.6
Diphtheria	40.4	23.6	15.8	13.8
Tuberculosis	210.9	192.3	145.8	149.0

(This increase of mortality from tuberculosis in 1918 as being higher than that in 1915 is attributed to the cause of the influenza epidemic.) By studying the comparative death rates from the above tables, we can now readily see evidence of the good results of the advancement of modern science. In short, the object of scientific medicine is not only to fight against disease when the scourge occurs, but to immunize the people against the scourge.

Before concluding, I would like to point out that it is amazing to witness the skeptical manner in which Western medicine is viewed by even some of our highly educated countrymen. Most of them entertain the idea that Western medicine is certainly good as far as surgery is concerned but that our native physician is perhaps superior in internal medicine. Such skepticism is due no doubt to the fact that China has existed for ages depending on her own resources and knowledge. Although it is true that our country has possessed agriculture, mining, military tactics, astronomy and what not for thousands of years, yet we are even now learning these from Western countries. We have learned with advantage other sciences from foreign countries, why should we then neglect a system of medicine with the same scientific foundation? Let me also call your attention to the opportunities for general education open to all of you. May I advise you all to take the trouble to visit some medical and health institutions before ending your study here? This you should do, not so much for your own pleasure, but as a debt you owe to your country, because your medical brothers and sisters will need your co-operation in promoting the health of your nation in the near future.

In closing, my friends, let me beseech you not to judge me too harshy in my criticism of our country's failures. If we want a progressive, strong China, we must do and act as others have done in making their own countries progressive and strong. I am prompted to take such a step by the feeling of true patriotism,—a love for our country which makes one long to see one's people accepting the challenge of civilization and taking their place beside their Western friends in the fight for a better world to live in.

TANG TSUNG NIEN, M.D.,
Senr. Med. Officer, Taheiho.

SUMMARY OF SIXTH ANNUAL GENERAL REPORT, 1918.

Harbin, 20th October, 1918.

To His Excellency,

The Minister for Foreign Affairs,
Peking.

Sir,

I have the honour to submit a summary of the sixth Annual General Report of the North Manchurian Plague Prevention Service for the year ending September, 1918.

2. I beg to thank you for your communication of 6th October, 1917, informing me that the Diplomatic Body in Peking has consented to the fixing of our Service appropriation in Taels (60,000) instead of Roubles 78,000 for the current year. The value of the rouble has fluctuated considerably during the past year, varying from 801 in May to 2092 in February per hundred taels as compared with Rs. 130 per hundred taels in pre-war times. The present buying capacity of the rouble is less than one-tenth of its former value, and it can therefore be readily understood with what relief the change has been received by all members of our staff.

3. From 13th of December onwards reports reached Peking from missionaries resident in Mongolia that an epidemic resembling Pneumonic Plague had broken out in that region. I was instructed by the Foreign Office and the Ministry of Interior to proceed to the spot and investigate. I left Peking on January 2nd of this year and, travelling by the Peking-Kalgan Railway, reached Fengchen, the terminal station, the next evening. The weather was cold and facilities were scarce, but I found no difficulty in definitely diagnosing Pneumonic Plague in a passenger who was on the point of leaving Fengchen Railway Station for the South. Apparently the epidemic had already reached the northern terminus of the Peking-Kalgan Railway, and the Government wisely took immediate steps to stop the traffic on the line. But the disease had already made considerable headway elsewhere, for the cart routes from the infected regions southwards were unguarded and several towns in Mongolia, Suiyuan, Shansi and Chihli were attacked. Thanks to the energetic action taken by the Ministry of Interior, headed by Vice-Minister Yu Pao Hsuan and by Tuchun Yen Hsi San of Shansi, who called in medical aid from all sources,

the epidemic was finally stamped out in April with the loss of sixteen thousand lives.

4. So far as our information went, the epidemic started in the nighbourhood of the small town of Patsebolong in Southern Mongolia, travelled eastwards to Paot'ouchen and Saratsi, then invaded Suiyuan and Kweihua, from which it spread later on eastwards to Fengchen, Tatungfu and the railways, and southwards to Soping, Tsoyun, Sochow, through the Great Wall into Taichow, Hsinchow, and neighbourhood of the capital city of Taiyuanfu. Isolated cases also occurred afterwards in Hsuanhuafu, Peking, Tsinanfu, Pengpu, Chengting, and even Nanking on the South of the Yang-tse River.

Altogether a vast area of ground was covered, comprising eight provinces (Southern Mongolia, Suiyuan, Chahar, Shansi, Chihli Shantung, Anhui, Kiangsu) and five railway-lines (Peking-Suiyuan, Chengting-Taiyuan, Peking-Mukden, Peking-Hankow, and Tientsin-Pukow.)

It is interesting to note that in this, as in the great Manchurian Plague of 1910-11, the epidemic started in the waste regions of Mongolia towards the end of autumn and disappeared at the approach of spring. No rodents or insects played any part in its transmission, which was done purely through the breath passing from one sick person to another. Further research will probably prove that the early cases occurred among settlers in those portions of Mongolia which have been markedas endemic centres of the disease.

5. During the height of the epidemic in Shansi, a rumour reached Harbin that suspicious cases had occurred on 29th January at Tsitsihar, capital of Heilungkiang province. We at once dispatched Medical Officer Ling Ting Fan and assistants to the spot to investigate. The Chinese Eastern Railway also sent Dr. Askanoff to co-operate with us, and after some days both doctors were able to wire that no Plague was present in the region mentioned.

While on this matter, it may be interesting to note that about the same time, five cases of undoubtedly Pulmonary Plague were discovered at Ipswich in the county of Suffolk, England. Adequate precautions were immediately taken, and the threatened epidemic was soon stamped out.

6. The early days of spring brought another rapidly-spreading but fortunately less serious epidemic in the form of Influenza (la Grippe) which was first recognised by us in Harbin in the first week of April. More than half of the inhabitants (Chinese and Russian) were attacked. Fortunately the majority of cases were mild, and no deaths were reported. One of the most serious seen by us was that of one of our medical officers, who experienced sore throat,

severe headache, high fever, profuse running from the nose, bronchitis and aching pains all over the body leaving him weak for two weeks afterwards. From Harbin, the epidemic spread in all directions and followed the usual route of travel by land and sea, and soon reached Peking, Tientsin, Shanghai, Canton, and even some tropical regions. Apparently, this epidemic is the same as that prevailing in Europe, known as the Spanish Disease, which has caused much havoc among soldiers and civilians. It is acknowledged in Germany that over 180,000 of her soldiers caught the disease this year. One interesting fact ascertained from this world-wide infection is that the characteristic microbe (bacillus of Pfeiffer), hitherto regarded as the cause of Influenza, has been found in only ten percent of the cases examined. The disease at this moment of writing is still prevalent in Harbin, Peking, Japan and Vladivostock.

Like Scarlet Fever, Influenza appears to have been introduced into China within recent years, and the Government will do well to bear in mind that although mild at present, it may, unless the necessary hygienic precautions are adopted, take a virulent form in the course of years, as has been the case of Scarlet Fever.

7. Owing to the political troubles in Russia, and the influx of all classes of people into Manchuria, many kinds of insect-borne disease have been admitted into our Hospitals. Among these, Typhus Exanthematicus and Relapsing Fever, both caused by the body louse, were predominant. Two of our Customs officers stationed at Suifenho were attacked by the former and one died. Cases of Typhus were quite common during the summer months—usually in a milder form. Of twenty-five Chinese soldiers admitted for this ailment into our Harbin Hospital, only one died.

Cases of Small Pox were also treated in the spring, but these are not exceptional as compared with preceding years.

No sign of Bubonic or Pulmonary Plague has been seen throughout Manchuria, thus making 1918 the eighth clear year so far as this dread disease is concerned.

8. Severe disturbances occurred at Blagovestchensk in March, during which much killing and plundering were noticed. Our Medical Officer at Taheiho, situated just on the other side of the River Amur, reported that for over a month our Hospital was used as a Red Cross Institution for the wounded and homeless, who received all the kindness and attention we could offer. It was fortunate we had an adequate medical staff stationed so near the scene of disturbances, for every case admitted received satisfactory treatment.

9. The present unsettled conditions caused by Bolshevik and enemy propaganda in North Manchuria and Siberia have

resulted in the dispatch of Chinese, Japanese and Allied forces to these regions since the beginning of this year. Chinese troops are now guarding various stations on the Chinese Eastern Railway from Changchun northwards, whilst soldiers of the other Allies have helped the Czecho-Slovaks in freeing the country from Vladivostock westwards as far as the Urals. The want of suitable accomodation has been much felt by all parties in Harbin.

10. Since the American Red Cross Society in Siberia has officially undertaken the organisation of the Medical Service for the Czecho-Slovaks, we have written to Dr. R. B. Teusler, Head of the American Red Cross Society operating in these parts, offering them the use of part of our Hospitals at Harbin, Lahasusu, Sansing and Taheiho for their work in case of necessity.

In the meantime, I am glad to state that the Japanese Military Red Cross, working in the Amur regions, asked for and obtained from us permission to use one of the three main blocks of buildings of our new Taheiho Hospital. Such practical co-operation will, I am sure, prove beneficial to the cause of the Allies.

11. Another result of the internal troubles in Russia has been the rise in price of land, house rent and all commodities, caused by the escape of wealthy refugees into these parts. The house rents of our Office and quarters for our Medical Officers have been raised tenfold, and we are not sure the limit has been reached. To avoid further trouble, I decided after consultation with the Lay Director to purchase a suitable piece of land in the New Town lying on the highway now being laid between the Chinese city and New Town. The price paid for the lot was Rs. 45,666.94 corresponding to $4,500.

12. The second Scientific Report of the Service, covering the years 1914-17, was published last December in English and Chinese by the Peking Gazette Press. It comprises most of the work we have been doing during the last four years and includes various articles dealing with our researches on Plague and other medical subjects, which have appeared in different scientific Journals, such as, British Journal of Hygiene, American Journal of Infectious Diseases, Journal of Rockefeller Institute, Modern Hospital (America), China Medical Journal, National Medical Journal, etc. This publication has been sent to many technical libraries and been favourably received in all scientific quarters.

13. Our Research Department has continued its labours during the past year. As usual, we have been consulted by the authorities on sanitary improvements, analyses of pills, water, patent medicines, etc. Our work is, however, handi-

capped by the want of suitable laboratory accomodation, for the present buildings were hurriedly erected eight years ago soon after the plague and are too cold in winter for continuous investigation. We are planning to construct next spring a more satisfactory hospital for this special work. We have already postponed building operations twice on account of increased cost due to the war, but labour and cost of materials are still rising and it is inadvisable to delay the matter further.

14. I attended the Conference of the Japanese Medical Association of South Manchuria held at Dairen on 22-23 September of this year, and delivered an address of welcome from the National Medical Association and the China and Pharmaceutical Society.

Remarkable progress has been made by our Japanese colleagues during the last ten years both in hospital administration and research work. In the domain of nursing I believe they are second to none.

At the invitation of the Taoyin and the Commissioner of Customs of Yingkow District, I paid two visits this year to Newchwang, in order to consult with them regarding the establishment of a Quarantine Hospital in that port. Outbreaks of Bubonic Plague and Cholera have already occurred there and are ever threatening the safety of the trade and its inhabitants. We therefore considered such a hospital most essential and jointly dispatched a memorandum to the Central authorities requesting its establishment.

15. The number of out-patients treated at the different hospitals in 1917-18 are set down in the following table as compared with preceding years :—

	1917	*1916*	*1915*	*1914*	*1913*
Harbin	10,501	10,652	14,587	19,395	19,167
Taheiho	6,394	6,847	7,173	7,231	7,548
Sansing	4,046	3,740	3,693	3,684	4,139
Lahasusu	1,089	1,018	1,221	1,338	1,830

These figures do not include Customs, Post Office, Government employees and private patients. The number of inpatients treated at Harbin Hospital was 470, the majority of whom were surgical.

16. The following comprise the principal *personnel* of the Service during the past year :—

Dr. Wu Lien Teh, Director and Chief Medical Officer.
Mr. P. Grevedon, (Commissioner of Customs) Lay Director and Treasurer.
Dr. J. W. H. Chun, Senior Medical Officer, Harbin.

Dr. Fred. Eberson, Bacteriologist to the Service working at the Rockefeller Institute, New York; now temporarily detached for war work in America.

Dr. Tang Tsung Nien, Resident Medical Officer, Sansing.

Dr. Lin Chia Swee, Resident Medical Officer, Taheiho.

Dr. Ling Ting Fan, Assistant Medical Officer, Harbin.

Dr. Shih Chi Liang, Assistant Medical Officer, Harbin.

Dr. Hubert A. Kwan, Resident Medical Officer, Lahasusu; joined the Service on 1st. October, 1918; temporarily stationed at Harbin.

Mrs. Chen Chin Tsai, Deputy Female Medical Officer, Taheiho.

Mrs. Hsu Shu Tung, Matron, Harbin Hospital; joined the Service on 1st. June, 1918.

Mr. Chou Yu, Senior Dresser-in-charge, Lahasusu.

17. The signs of prosperity both in the Chinese and Russian towns of Harbin, to which I drew attention in my 1917 Report, have steadily increased during the past year. New houses and factories are being continually put up, and fabulous sums are paid for land and houses. The Russian population has doubled itself, while the Chinese have trebled in number during the last four years. A pure water supply system for this large population of nearly 200,000 is urgently needed in place of the unsatisfactory individual wells which cost nearly Rs. 10,000 each to construct. With such a large river as the Sungari near by, an unlimited supply of water is easily procurable.

Similar signs of prosperity are noticeable in all the towns lying along the railway and situated on the Sungari and Amur Rivers where large tracts of land have been opened and cultivated. We are still waiting for a macadamised road to be constructed from the main throughfare of Fuchiatien to our Hospital so as to facilitate the transport of patients. As matters stand at present, the road leading to Harbin Hospital is impassable in wet weather to all except pedestrians, who use the narrow, rickety, wooden footpath lying on either side of the road.

In spite of the lessons of the past and the wonderful achievements of modern medicine which this great war has brought forth, the majority of our people are still unwilling to put their complete faith in scientific medicine. Our authorities are not yet alive to the urgent need of a scientific and technical education, and whatever efforts made hitherto have been of a spasmodic character. I earnestly hope that when the Powers other than America decide to return the balance of the Boxer Indemnity, amounting to tens of millions of pounds sterling, a considerable sum of money will be earmarked for the noble purpose of medical education, preventive medicine and hospital development, without which no country may be called progressive. Our nation is backward because the minds and bodies of her citizens are backward, and only a proper understanding of scientific thought as exemplified in the practice of modern hygiene can alleviate it.

The Peking Central Hospital upon which I had devoted several years of preparation was formally opened on 27th. January, 1918, and may be regarded as one of the many undertakings required to keep this country abreast of the times.

18. I wish to conclude this Report by expressing my appreciation of the valuable services rendered by the several members of our staff, to whose skill and devotion to duty the reputation of the Service as an efficiently managed Chinese Government institution is mainly due.

To my colleagues of the Chinese Eastern and South Manchuria Railways, I wish as in former years to tender my cordial thanks for their cooperation. To the Chinese Government, Chinese Eastern and South Manchurian Railways, I am indebted for their courtesy in providing me with free passes to travel on their lines.

Lastly, I am grateful to the Customs Officers at various stations in Manchuria for frequent assistance rendered to members of our Service.

I have the honour to be,
Sir,
Your obedient Servant,
Wu Lien Teh.
Director and Chief Medical Officer.

SUMMARY OF SEVENTH ANNUAL GENERAL REPORT, 1919.

Harbin, 20th. December, 1919.

To His Excellency,
The Minister for Foreign Affairs,
Peking.

Sir,

I have the honour to submit a summary of the Seventh Annual General Report of the North Manchurian Plague Prevention Service for the year ending September, 1919.

2. I beg to thank you for your communication of 9th. October, 1918, informing me that the Diplomatic Corps had agreed to continue the withdrawal from the Customs Revenue of our annual appropriation in Tael currency. The history of the past year has shown the wisdom of this step, for although Peace has been declared, gold, and particularly the rouble, continues to depreciate. In fact, it may be said that the paper rouble is now practically worthless on the market, a Chinese tael at this time of writing being equivalent to over 350 roubles (Kerensky.)

3. *Influenza.* Two severe epidemics, occurring as parts of the general pandemics of the world, have wrought great havoc throughout China during the past year. These are Influenza and Cholera, each claiming at least 300,000 deaths in course of a few months.

4. The Influenza epidemic, reported first by us in Harbin in March, 1918, became pandemic in the course of the year and rapidly assumed a virulent form. An enormous number of cases were reported from every country both in the tropical and temperate zones, and a considerable percentage (varying from 10 to 20) developed Pneumonia which often ended fatally. It was as severe in hot countries, like the Straits Settlements as in cold places like Manchuria, and as prevalent in countries with up-to-date sanitary organisations like America as in less hygienic provinces in India. Such a pandemic had not been encountered since 1889. It is estimated that about eight million people died from it, including 500,000 in America and five million in India. Its invasion of China does not appear to have been as severe as in most other countries. Although hundreds of medical men have been especially engaged in investigating its character, the actual cause still leaves much room for doubt, but it is probable that the organism is a filterable virus, which either singly or in combination with other throat organisms, produces the severe condition in the lungs. The use of the gauze and cotton

mask has been condemned by some authorities in America, but until it is definitely proved that the causal germ is a filterable one, and nothing else, it will not be wise to abolish it, especially in hospitals and crowded places in times of epidemic.

The onset of cold weather this October has again led to a recrudescence of Influenza in several countries, including China, but so far the fatal cases reported have not been as many as in the corresponding months of last year.

5. *Cholera.* The long spell of hot dry weather, coupled with the presence of a record number of flies, has facilitated the entry into Manchuria through the port of Newchwang, of the Cholera epidemic which had been raging for some time in South China.

It may be remembered that the first public intimation in China of the presence of an outbreak of Cholera was an appeal for funds from the Foochow Red Cross Chapter 'where hundreds of Chinese were dying daily'. Apparently the disease had reached that city from the Philippines, where Cholera is endemic. From that locality, the epidemic travelled northwards and southwards, visiting Swatow, Shanghai, the Yangtze Valley, Tientsin, Langfang, Peking, Newchwang, Dairen, Mukden, Harbin, Kirin, Hulan, Sansing, along the Sungari and Amur Rivers as far as Aigun, Vladivostock, Siam, Korea, Osaka, Tokio and other parts of Japan. The course of the epidemic was most rapid, and followed the usual lines of human travel by sea and land. The epidemic reached its climax in August, and appeared to be conveyed as much by flies as by contaminated water. With the onset of rain and cooler weather, the disease abated considerably and was definitely stamped out in Fuchiatien on 10th. September, and other parts of China by the end of September. In some parts of Korea and Japan, however, cases were reported up to the last week of November.

6. The first case of Cholera in the Chinese city of Harbin was located on 3rd. Aug. in the licensed quarter in the person of a native of Shanghai. He died the next day. The first in-patient suffering from the disease was admitted on 5th. August. His stools were characteristic and from them the Cholera vibrio was cultivated. Roger's hypertonic salt solutions were infused into his veins, affording much relief to the patient and prolonging his life. But he declined food, even rice water, and died on the eighth day after admission. In the meantime, the epidemic had rapidly spread, patients being found among Russians and Japanese as well as among Chinese. Ours was the first Hospital available for the admission of large numbers of patients, and at the request of the Japanese Consul-General we reserved a special ward in the Isolation

Compound for the treatment of Japanese patients. The American Red Cross lent both doctors and nurses to us besides supplying needed medicines and bearing part of the expenses. The British community headed by Consul H. E. Sly, C. M. G. also raised a substantial sum of money to assist us in our campaign. The Japanese merchants presented us with 225 pounds of carbolic acid as a taken of their appreciation of our services to their nationals. Besides the present hospital, we erected a special temporary hospital accomodating 80 patients in the Chinese city and the Russian Railway authorities kindly lent us eleven railway wagons for the housing of convalescents.

The height of the epidemic in Harbin was reached about the middle of August and coincided with the driest part of the summer and the largest number of flies. The maximum number of deaths per diem in the Chinese city was 207 and occurred on 15th. August. Admissions into the Plague Prevention Hospital totalled 1962 with a mortality of 275, i.e. 14.11 per cent.—a highly satisfactory record, brought about by the systematic use of hypertonic salines.

The full scientific report on this epidemic is being published separately, but the following comparative tables may be found interesting:—

1. Hospital Statistics.

Name of Hospital.	*No of Admissions.*	*Deaths.*	*Mortality rate.*
Russian Central (Harbin)	400	135	33.75%
,, Municipal (Harbin)	180	104	57.77%
Japanese Epidemic (Dairen)	1,256	707	56.30%
Ch. Anti-plague (Harbin) ...	1,962	275	14.11%
New Ch. Cholera (Harbin) ...	185	33	17.89%
Vladivostock (Russian)	200	133	66.50%

11. Mortality Statistics.

Nationality,	*Location.*	*No. of deaths.*
Japanese	Railway & Chinese area	60
Russian	Railway area	705
Chinese	All parts of Harbin District	3,738
	Total. ...	4,503

7. *Plague.* Towards the middle of January of this year, there appeared reports of an outbreak of Pneumonic Plague in the district of Linhsien, 100 miles from Taiyuanfu, Shansi. Dr. Watson and other doctors proceeded to the spot to in-

vestigate, but from spleen puncture, cultural methods and microscopical examination they were satisfied that the deaths were not due to Plague. It is probable that these deaths were accompaniments of Influenza in the lungs.

On 11th September, news came from Ikievskaya, a Siberian station about forty miles west of Manchoulie, saying that two cases of Bubonic Plague had been diagnosed in the neighbourhood, one in the cervical and one in the axillary region. These cases were confirmed by bacteriological diagnosis, and for a time some panic was caused. The strictest measures were taken to prevent the spread of the disease into China. No further cases were reported, and the two might be classed among such isolated cases of Bubonic Plague as have from time to time occurred in Siberia, in which regions it is known to be endemic.

Some cases of Bubonic Plague also occurred on board the *Nagano Maru* at Yokohama last June, while at Hongkong the regular spring outbreak of Bubonic Plague seemed to be of a slightly more severe form.

Manchuria has been, however, entirely free, and this makes the ninth consecutive year in which Plague has not appeared in this province.

8. *Typhus.* The Typhus epidemic, which swept over Servia and Russia five years ago, has claimed numerous victims in Siberia since then. Precautions had from time to time been taken by us to prevent it from taking a permanent hold. Owing to the unceasing flow of poor, underfed and underclothed refugees into these parts, a scheme was jointly devised by the Chinese and Russian sanitary authorities, by which the homeless might be adequately cared for in a large camp, and thus cases of Typhus might be isolated and the contacts watched. Medical Officers were also stationed from 1st April, at the principal stations of Harbin, Pogranitchnaya, Manchoulie and Kwangchengtzu, until they were no longer required.

9. The long-expected Treaty of Peace between the Allies and Germany was signed at Versailles on 28th June.

There appears a section on opium, which reads :—

Art. 295.—"Those of the High Contracting Parties who have not yet signed, or who have signed but not yet ratified, the Opium Convention signed at the Hague on 23. January, 1912, agree to bring the said Convention into force, and for this purpose to enact the necessary legislation without delay and in any case within a period of twelve months from the coming into force of the present Treaty."

Among the Article of the Covenant of the League of Nations, which is appended to the Treaty, are some of particular interest to medical science, namely,

Article 23 :—

(a) The Members of the League will endeavour to secure and maintain fair and humane conditions of labour for men, women, and children, both in their own countries and in all countries to which their commercial and industrial relations extend, and for that purpose will establish and maintain the necessary internatioial organisations.

(c) The Members of the League will entrust the League with the general supervision over the execution of agreements with regard to the traffic in women and children, and the traffic in opium and other dangerous drugs.

(f) The Members of the League will endeavour to take steps in matters of international concern for the prevention and control of disease.

Article 25.—The members of the League agree to encourage and promote the establishment and co-operation of duly authorised voluntary national Red Cross organisations having as purposes the improvement of health, the prevention of disease, and the mitigation of suffering throughout the world.

10. *Bandits.* On 17th August, a party of 127 Hunghutzus raided the town of Sansing after having overpowered the Government forces some miles away on the previous day. They took away four of the leading merchants as hostages, and kept them until a sum of 70,000 Mex. dollars had been paid. This was done four days afterwards. Our Resident Medical Officer, Dr. Hubert A. Kwan, was requested by the bandits to attend eight of their wounded. He found two seriously wounded through the lungs and the others slightly. They showed our Medical Officer every politeness and even offered to pay for professional services rendered. The bandits stayed in the city for only one day, the majority leaving on the 18th and the rest four days after.

11. The condition of the River Sungari this year has been one of the worst on record. The water was unusually low, business was practically at a standstill, and the visitation of the Cholera as well as the activities of bandits frightened every one. A trip to Sansing, usually occupying 24 hours, lasted a week or more this year, because of lack of water and fear of bandits.

Until the beginning of September, very few steamers were able or willing to proceed to Aigun, because of these uncertainties and the unprecedented depreciation of the rouble.

12. It will be seen from the above that we have had a very unsettled as well as exciting year, but one and all of our staff have worked splendidly, as is witnessed by the excellent results, obtained in the anti-cholera campaign.

Bowel diseases have also shown a marked increase during the year, due no doubt to the impure water brought about by the dry weather and to the extraordinarily large number of flies.

A considerable proportion of admissions in our and the Russian hospitals constituted cases of Typhoid and Dysentery, several of which proved fatal. Typhus and Small Pox were seen in considerable numbers during the summer.

13. With the exception of the two months of the Cholera epidemic, during which we admitted only patients suffering from that disease, our hospitals have been kept unusually busy both for out-and-in-patients. At Harbin, a record number of major operations were performed by our staff.

The following is a table of the number of out-patients treated at our various hospitals during the year 1918-19 :—

	1918	*1917*	*1916*	*1915*	*1914*	*1913*
Harbin	10,474	10,501	10,652	14,587	19,395	19,167
Taheiho	6,513	6,394	6,847	7,173	7,231	7,548
Sansing ...	3,677	4,046	3,740	3,693	3,684	4,139
Lahasusu ...	979	1,089	1,018	1,221	1,338	1,830

The above figures do not include Customs, Post Office, Government employes and private patients. The Cholera patients (numbering 1962 at Harbin) are also not included.

14. As a result of the universal desire to confine opium, morphine and kindred drugs to proper medicinal uses, the International Anti-Opium Association, Harbin Branch, was established in this city on 29th March, with the Taoyin, Mr. Fu Chiang, as President, General Afanasief and three other influential residents as Vice-Presidents, and Dr. J. W. H. Chun as Secretary. Since its inauguration the Harbin Association has contributed much valuable information to the Headquarters in Peking regarding the prevalence of poppy cultivation in Manchuria and also the extent and ramifications of the opium and morphine trade. It is hoped that the united efforts of the better elements of the people in China and other countries may soon accomplish the suppression of these insidious evils.

15. During the past year I have visited Newchwang a few times in order to make arrangements for the establishment of a new Quarantine Hospital in that city. For this purpose, the Central Government have sanctioned an appropriation of Tls. 40,000 for building and equipment and Taels 1,250 monthly for running expenses. This new Hospital. which will be formally opened next May, will be incorporated in the Manchurian Plague Prevention Service.

At no time was the need of such a Hospital more acutely felt than during the epidemic of Cholera last August, when make-shift arrangements had to be made to suddenly accomodate the large number of patients suffering from that disease. It is earnestly hoped that our Government will continue to build and maintain these necessary and humane institutions, so as to fulfil the needs of the times.

16. Thanks to the continued unrest in Russia, the allied blockade and the unlimited circulation of easily forged paper currency, the Russian rouble has fallen to an unprecedented low level and has inflicted untold misery among deserving classes of Chinese and Russians. The following table shows the comparative value of the rouble during the past year :—

1918	October	Tls. 100	equal	to	Kerensky Rs.	1,471.00
	November	100	,,	,,	,,	1,112.00
	December	100	,,	,,	,,	1,300.00
1919	January	100	,,	,,	,,	1,518.00
	March	100	,,	,,	,,	1,745.00
	April	100	,,	,,	,,	3,809.88
	May	100	,,	,,	,,	4,010.40
	June	100	,,	,,	,,	3,954.70
	July	100	,,	,,	,,	5,447.46
	August	100	,,	,,	,,	6,628.30
	September	100	,,	,,	,,	7,185.30
	October	100	,,	,,	,,	17,645.76
	November	100	,,	,,	,,	24,500.00

17. I have to thank the President for his Mandate of 20th March, conferring upon me the Chia Ho decoration of the Second Class and also granting my request for suitable recognition to members of our medical and administrative staff, who have received decorations varying from the 4th to the 7th Class Chia Ho.

18. Last February, Mr. Ivan Chen (then Commissioner of Foreign Affairs, Shanghai) and I were appointed by the Wai Chiao Pu to superintend the burning of the 1207 chests of Indian opium in Shanghai. Our report upon that mission has already been submitted. As a recognition of this work,

the President was kind enough to confer upon me the Pao Kuang Chia Ho decoration of the Third Class.

The ratepayers of Harbin Railway area have also elected me to sit as a Councillor on their Municipal Council.

19. The following comprise the principal *personnel* of the Service during the past year:—

Dr. Wu Lien Teh, Director and Chief Medical Officer.
Mr. P. Grevedon, (Commissioner of Customs) Lay Director and Treasurer, on leave from 21st October, 1919.
Mr. R. C. L. d'Anjou, (Commissioner of Customs) Lay Director and Treasurer, assumed duty on 21st October, 1919.
Dr. J. W. H. Chun, M.B., B.C. (Cantab) Senior Medical Officer, Harbin.
Dr. Tang Tsung Nien, granted leave from 1st August to do postgraduate work at Johns Hopkins University, Baltimore U.S.A.
Dr. Lin Chia Swee, Resident Medical Officer, Taheiho.
Dr. Ling Ting Fan, Assistant Medical Officer, Harbin.
Dr. Shih Chi Liang, Resident Medical Officer, Sansing.
Dr. Hubert A. Kwan, Resident Medical Officer, Lahasusu.
Dr. Kwan Jen Min, Assistant Medical Officer, Harbin.
Mrs. Chen Chin Tsai, Deputy Assistant Medical Officer, Taheiho.
Miss Chen Chi Ching, Sister-in-charge, Harbin Hospital.
Mrs. Hsu Shu Tung, Matron, Harbin Hospital, resigned in Septemebr.
Mr. Lu Tan Shu, Senior Dresser-in-charge, Lahasusu Hospital.

20. The signs of prosperity, which I commented upon last year, continued steadily this year until September, when the serious reverse to the Koltchak forces and the removal of the Government from Omsk to Irkutsk produced a panic on the market and brought down the paper rouble to an unheard-of point. From that time onwards, practically no large business has been done by the merchants, the majority suffering heavy financial loses. It is feared that with the approach of the incoming year, at least half the shops will close their doors and a large porportion of the new buildings which have sprung up like mushrooms will be abegging. This state of affairs will probably be transitory for Harbin is destined from every point of view to become the chief mart of North Manchuria. At least six foreign and as many Chinese banks have established branches in Harbin to meet the increasing needs of merchants.

21. I wish to conclude this report by recording my appreciation of the valuable services rendered by the several members of our staff, especially during the Cholera epidemic, which brought out all that was best in them. To the help given by American Red Cross and the British community I have already alluded.

To my colleagues of the Chinese Eastern Railway and South Manchurian Railways I desire, as in former years, to tender my cordial thanks for their co-operation. To the Chinese Government, Chinese Eastern and South Manchurian Railways, I am indebted for their courtesy in providing me with free passes to travel on thier lines.

Lastly I am grateful to the Customs Officers at various stations in Manchuria for frequent assistance rendered to members of our Service in the Course of their duty.

I have the honour to be, etc.,
Wu Lien Teh.
Director and Chief Medical Officer.

SUMMARY OF EIGHTH ANNUAL GENERAL REPORT, 1920.

Harbin, 1st August, 1921.

To His Excellency,
The Minister for Foreign Affairs,
Peking.

Sir,

I have the honour to submit a summary of the Eighth Annual General Report of the North Manchurian Plague Prevention Service for the year ending September, 1920. Owing to the pressure of work connected with the organisation of measures against the recent epidemic of Pneumonic Plague throughout Manchuria, this report has been delayed. It is proposed to bring it up to date by embodying as an appendix a resume of their outbreak from its appearance in October until its suppression in May, 1921.

2. I have to thank you for your dispatch of 31st January, 1920, informing me that the Ministry of Finance and the Diplomatic Body have agreed to the appropriation of Hk. Tls. 60,000 to meet current expenses of the present financial year. How necessary such expenses are may be gauged by the prompt way in which we have managed with its help to suppress the visitation of plague.

3. *Influenza.* A fresh invasion of influenza took place in many countries (including China) and complications appeared as common as during the preceding year. Thanks to the early precautions taken, the mortality in this country was not high, though at certain places like Mulanhsien in Kirin (220 li down the river from Harbin) whole families were swept away by the scourge in November, 1919. In Japan and United States it wrought great havoc. Official Japanese statistics show that from 15 Sept. 1919 to 9 Feb. 1920, the number of Influenza cases throughout Japan was 1,724,362 with 65,852 deaths (3.8%). In Osaka alone, there were 385,643 cases with 10,183 deaths. The epidemic varied in different parts of Manchuria. At Hulanfu (opposite Harbin) and Lahasusu the main symptoms noticed were cough, fever, headache and sometimes spitting of blood, which were mistaken by the inexperienced to be those of Pneumonic Plague. At Tung Yuan Hsien, both the Megistrate and his wife died of the disease. Our records at Lahasusu showed 35 deaths out of 250 cases among a population of 1,800.

Cholera. Although a considerable epidemic of Cholera occurred in Japan and Korea during the summer (5,000 in the former and 18,000 in the latter having been recorded), China and Manchuria were practically free from the disease. This outbreak started from Formosa at the end of May, appeared at Kobe on 7th June, and invaded city after city in Japan until the whole empire was practically infected. From China only a few isolated cases were reported, such as Antung (nine), Ichang, Shanghai. In Harbin only four authentic cases were found, namely, one Chinese in Pristan (fatal), one Russian (recovered), and two Japanese soldiers (fatal).

Typhus. Owing to the influx of thousands of discharged Russian soldiers from Siberia into Manchuria, Typhus fever was much encountered. In April, 1920, over 300 cases were admitted into the various hospitals in Harbin. Happily, the infection did not spread among the civilians or develope into an epidemic. During the period November, 1919—May 1920 our sanitary police in the charge of a medical officer were in constant attendance at the Railway Station, examining incoming and outgoing passengers and removing any sick found to the Hospital.

Typhoid Fever was not unusually marked.

Dysentery was not particularly conspicuous.

Small Pox did not show much prevalence although spring and summer were very dry and dust storms frequent. As in previous years we encouraged free vaccination at our Hospitals.

4. The Quarantine Hospital at Newchwang, which had been in course of construction since the preceding May, was formally opened on 10th July, and attended by all the leading officials and commercial residents, foreign as well Chinese, in addition to representatives of the Wai Chiao Pu, Nei Wu Pu, Governor-General Chang Tso Lin and Shui Wu Chu. The establishment of this Hospital was timely, as Cholera was raging in Japan and Korea, and all vessels arriving at the port were duly inspected by our Medical Officers. Although some unnecessary scare was caused by interested parties, we were able to keep the infection from the city, thus winning the confidence of the community without inflicting any pecuniary loss upon themselves. A full description of this latest addition to our Service has been forwarded to the Board in a separate dispatch.

5. The work of constructing the new Bacteriological Laboratory, begun on 6th April, 1920 was completed on 15th September at a cost of $17,000. The building has two storeys besides a basement for the boilers, hot-water stoves, coal and artesian well. Both the steam-heating and plumbing plants came from England. The ground floor is devoted to administration offices, while the upper floor is occupied on one

side by the Bacteriological Department and on the other by the Library and Museum. It was fortunate for the staff that this up-to-date annexe to our Hospital was completed in time, for the plague epidemic might otherwise have found us short of proper laboratory facilities for prolonged winter investigation. The cost of this building has been obtained from the savings of our annual appropriation during the last few years.

6. I left Harbin on 6th August on a tour of inspection to the out-station hospitals on the Sungari and Amur. I reached Sansing on the 8th, Lahasusu on the 9th and Taheiho on 13th and returned to Harbin on the 27th. Many new villages have sprung up all along the route, particularly on the southern banks of the two rivers. At Taheiho, a large number of two storeyed buildings have taken the place of the old mud-houses and several new factories have been established, including two flour mills, one electric light plant and four saw mills. At the same time, a feeling of uncertainty seems to prevail among the population, owing to the frequent depredations by Hunghutzus, who are organised and led by intelligent chiefs. At Sansing, two days before our arrival there (22nd August), a party of over one hundred bandits invaded the city, took away the son of the Taoyin and burnt his yamen, and it was only the timely arrival of some unexpected troops that saved the city from a similar experience to that of last year. According to some close observers, the condition of the Sungari River ports has never been so bad for business as it is at present.

7. Our various hospitals have been the refuge at one time or another of interesting parties. At Taheiho, when the Bolsheviks escaped from the temporary invasion of Blagovestchensk by the Japanese, wounded and homeless Russians of both Koltchak and Bolshevik tendencies accepted our hospitality. Later on, when the Japanese troops were themselves driven out, their Red Cross Society asked for and obtained the loan of one of our large blocks, which they occupied until 22nd April, when all Japanese inhabitants numbering 400 left those regions. Before his departure the Japanese physician-in-charge expressed his best thanks for our courtesy rendered to him and his people in a time of need.

At Lahasusu, again, one hundred of Kalminoff's troops begged for quarters at our Hospital, after they had been driven away from Habarovsk in January. Here they remained until sent to Kirin in the charge of our soldiers. Later on, when winter came and the crew of the Chinese gunboats needed quarters, we loaned them some of the Isolation Blocks besides attending to their wounds and frost bites.

8. Among many new additions, we have installed a modern X Ray plant in Harbin Hospital, easy to work and

capable of taking excellent pictures. Already it has been considerably used for hospital and private patients for diagnosis and treatment.

9. Our Service accounts and savings have been so upset by the collapse of the rouble that the Lay Director and myself decided to introduce from 1st January, 1920 a Chinese dollar account and abolish and rouble account in vogue since the establishment of our Service in 1913.

10. The Joint Conference of the National Medical and the Medical Missionary Associations postponed last year took place in Peking from 21st to 28th February, 1920. Senior Medical Officer J. W. H. Chun and I read papers on the Cholera epidemic and other subjects. The sessions were held at the New Rockefeller Medical School, which had been erected at a cost of nearly $10,000,000 on the site of the old Yu Wang Fu. There was a record attendance of 200 foreign and 100 Chinese doctors. Our Service contributed fine Cholera and Plague pathological speciments and other medical exhibits.

11. The onset of winter of 1919 was earlier and the cold more severe than usual. The coldest point reached was on 7-9 February, when—33° C. was registered. The summer was fairly dry with fewer flies than in the preceding year. Wet weather set in on 9th June, after which it rained continuously for nearly three weeks. July was fairly dry with an even temperature of about 24 to 27° C.

12. Owing to the large number of Russian refugees and the constant influx of Chinese from the south to this central mart of North Manchuria, the population of Harbin and Fuchiatien has reached a total of 300,000 which will probably be augmented during the next few years. In spite of a considerable depression in trade and the uncertainties of the political situation, money appears to be plentiful, and house rents as well as food stuffs have never reached a higher figure than at present. In fact, of all large cities in China, Harbin may be said to be the most expensive.

13. Our hospitals have been open during the whole year for general cases. In addition to in-patients, numbering 566, the following attended the polyclinics at the various station hospitals during the year:—

	1919-20	*1918-19*
Harbin	11,468	10,474
Taheiho	6,585	6,513
Sansing	4,694	3,677
Lahasusu	1,885	1,088
Newchwang	3,230	—

The above do not include Customs, Post Office, Government employees and private patients.

14. The following comprise the principal *personnel* of the Service during the past year:

Dr. Wu Lien Teh, Director and Chief Medical Officer.
Mr. R. C. L. d'Anjou (Commissioner of Customs) Lay Director and Treasurer.
Dr. J. W. H. Chun, M.B., B.C., (Cantab), Senior Med. Officer, Harbin.
Dr. Tang Tsung Nien, returned from post-graduate studies at Johns Hopkins, U.S.A. Sept., 1920.
Dr. Lin Chia Swee, Senior Resident Medical Officer, Taheiho.
Dr. Lin Ting Fan, Resident Medical Officer, Harbin.
Dr. Shih Chi Liang, Resident Medical Officer, Sansing.
Dr. Hubert Kwan, Resident Medical Officer, Lahasusu.
Dr. Kwan Jen Min, Assistant Medical Officer, Harbin.
Mrs. Chen Chin Tsai, Deputy Medical Officer, Taheiho.
Miss Chen Chi Ching, Matron, Harbin Hospital.
Mr. Chao Ping Wen, Senior Dresser, Harbin Hospital.

15. I wish to conclude this report by recording my appreciation of the valuable services rendered by various members of our staff in maintaining efficiency of the Service. To the American Red Cross, I am much obliged for fourteen cases of drugs and hospital appliances presented to our Hospitals. To my colleagues on the Chinese Eastern and South Manchurian Railways I desire, as in former years, to tender my cordial thanks for their co-operation. To the Chinese Government, Chinese Eastern and South Manchurian Railways, I am indebted for their courtesy in providing me with free passes to travel on their lines. Lastly, I am grateful to the Customs Officers at various stations in Manchuria for frequent assistance rendered to members of our Service in the course of their duty.

I have the honour to be, etc.,

Wu Lien Teh.

Director and Chief Medical Officer.

Appendix to Eighth Annual General Report.

The beginning of the Pneumonic Plague of 1920-21 was quite insiduous. As in the outbreak of ten years ago, it began in the Transbaikal district of Siberia towards the end of summer, when a Russian family, consisting of the woman, a son and two daughters, were reported to have been attacked by the disease in its bubonic form. With the exception of the man, treated at Manchouli Hospital, all died. Then two Cossack soldiers living in the same compound took the infection and died, the last on 20th Sept. After this no more was heard until October, when the wife of a Russian guardsman in charge of the Railway bridge at Hailar (117 miles east) died of Bubonic Plague. Three out of her five sons were infected and died; her husband also sickened but recovered. These later cases were seen by me at the Railway Hospital and were purely bubonic. Three Chinese soldiers living in the same compound also died of the disease. Owing to the free intercourse between the sick and some outside workmen, the infection was distributed in the city, and our efforts at segregation met with only partial success. During our stay at Hailar, we could trace the gradual evolution of the plague from the bubonic, through the septicemic into the pneumonic form, after which it became most infectious and dangerous. One day, the local Chief of Police was attacked by the soldiers and nine men under observation were set free by the soldiers. Some later deaths at Hailar were traced to these escaped ones, but two reached the coal mines of Dalainor (100 miles away) and spread the infection broad-cast among the coolies living in the semi-underground huts of that place. Manchouli was reinfected from Dalainor, and in its turn sent infected persons by rail to Tsitsihar, and later on to Harbin. In this way, the whole line from Manchouli to Vladivostock (1072 miles) and from Harbin to Chang-chun (150 miles) received the infection in a greater or less degree. Fortunately, however, owing to the early precautions taken by the Manchurian Plague Prevention Service and to the splendid co-operation displayed by the authorities of the Chinese Eastern, South Manchurian and Chinese Government Railways, as well as by most classes of people from Governor-General Chang Tso-lin downwards, the epidemic did not reach the colossal dimensions of that of 1910-11. Possible cases were rigidly controlled, and the passenger traffic, between Manchouli and Harbin was stopped from 1st February. Third class traffic from Harbin to Changchun was limited to only 150 persons, who after inspection at Harbin, had to undergo quarantine for a further period of five days at Changchun. In this way, although the number of deaths at Harbin was considerable, comparatively few cases occurred south of this city. For instance, the whole of Changchun district only claimed 77 deaths from plague, and Mukden only four deaths, as compared with 5000 deaths in each city during the epidemic of ten years ago. The population of Manchuria had increased from 12 millions to 22 millions, while that of Harbin had jumped from 70,000 to 300,000 during the intervening ten years. Whereas at least 50,000 plague deaths were recorded in 1910-11, only 8,500 persons died in the epidemic of 1920-21. These are satisfactory figures and show what modern methods of prevention may accomplish in the battle against this most dangerous of all known diseases. It is hoped that our people may take this lesson to heart, and in future have more faith in their scientific men, for in the fight against such insiduous and unseen foes as plague germs only those experts who are specially trained can keep up their presence of mind and at the same time perform their duties effectively and economically.

Statistics. As said above, the last epidemic started in Siberia, but later on, when the cases at Manchouli were many, especially among Russians, certain towns in Siberia were re-infected by escaping refugees. In Manchuria proper, the following table shows the places infected from west to east together with the first cases reported and total number of deaths :—

Manchouli	Sept.	7	1141	(R. 334 : Jap. 1)
Dalainor	Jan.	13	1017	(R. 4 :)
Hailar	Oct.	22	98	(R. 27 :)
Mentuho	Jan.	30	4	
Buketu	Feb.	3	25	
Ananchi	Feb.	3	82	
Tsitsikar Station	Jan.	27	88	
Tsitsikar City	Jan.	18	1734	
Fulardi	Feb.	10	48	(R. 3 :)
Anda	Mar.	19	25	
Tuichingsan	Mar.	5	28	
Harbin district	Jan.	22	3125	(R. 8 : Jap. 3)
Hulan	Feb.	7	322	
Asheho	Feb.	12	123	
Imiampo	Mar.	15	35	(R. 1 :)
Hantaoho Tzu	Mar.	27	16	
Shihtaoho Tzu	Mar.	25	19	
Hailin	Mar.	8	7	

Suifenho	Mar.	14	12	(R. 2:)
Shwangchengpu	Mar.	14	134	
Yaomen	Feb.	3	21	(R. 1:)
Changchun district	Jan.	31	77	
Yu Shu	Mar.	8	153	
Mukden	Mar.	29	4	
Koupangtzu District	Mar.	27	18	
Other cities		—	150	
Total for Manchuria			8508	

These figures include 380 Russians and 4 Japanese.

Other places infected besides Manchuria were :—

Vladivostock & Ussuri	Apr.	9		520	(R. 40 :)
Sangyuan dist. (Chihli P.)	Feb.	24		200	
Chefoo & Shantung	May	3	(by boat)	80	
				800	

Seven infected rats were discovered at Vladivostok as well as two human bubonic cases.

We made and distributed 60,000 anti-plague gauze masks and 8,000 doses of anti-plague vaccine from our Laboratory. In addition to our routine work, our staff took advantage of the occurrence of this rare epidemic to perform a series of important bacteriological investigations. A resume of our researches will be read partly at the opening of the New Rockefeller Medical School, Peking, on 16th September, 1921, and partly at the Conference of Japanese physicians at Port Arthur on 24th September.

SUMMARY OF NINTH ANNUAL GENERAL REPORT, 1921.

Harbin, 15th. December, 1921.

To His Excellency,
The Minister for Foreign Affairs,
Peking.

Sir,

I have the honour to submit a summary of the Ninth Annual General Report of the North Manchurian Plague Prevention Service for the year ending September 1921.

2. With the incoming of October, we have entered the tenth year of our existence as a government public health institution. To celebrate the occasion, we are publishing a special decennial volume, which will embody not only a history of our Service and its achievements but also various scientific articles written by our staff relating to the epidemic of pneumonic plague and other affections prevalent in these regions. This volume will it is hoped make its appearance within the next six months.

3. As a short account of the pneumonic plague of 1920-21 has already been submitted as an appearix to last year's annual Report, it is only necessary to state here that no other cases have occurred in Chinese territory since the last was reported at Harbin or Manchouli. As an example of post-plague psychology, it is interesting to note that for months after the last case was reported, in fact as late as October, the newspapers of Harbin, Mukden, Peking, Dairen and Shanghai, published outbreaks of plague at Hailar and Manchouli, confounding deaths from typhus, typhoid, influenza, smallpox, and anthrax with the dreaded pest. Similar rumours were circulated after the great epidemic of ten years ago, leading almost to political complications.

4. In Siberia, however, two limited outbreaks were recorded—the first one on August 8-17 at Daurija and Borsja (about 40-60 miles west of Manchouli) when four Russians died of Bubonic Plague, and the second on October 6-12 at Moulino (80 miles north-east of Borsja by road) when seven deaths among Russians occured from Bubonic Plague. The first epidemic was carefully studied by our Medical Officer Kwan. It appears that two employees of the Russian Railway skinned a tarabagan for eating and died on the 13th. and 17th. August respectively. A Russian doctor Goruloff stationed at Borsja operated upon the cervical swelling of the first

patient believing it to be an abscess, caught the infection and died of plague on the 17th. The second localised outbreak at Moulino was also supposed by the Russians to have originated from the skinning of a sick tarabagan, but the place was too far out in Soviet territory for our Medical Officer to reach, and so no personal investigations were made.

5. After the events related above occurred, we pursued our investigations on the direct relationship of plague infection among these Siberian marmots with man, and urged our Russian colleagues to be on the look-out for sick animals on the field. We placed at their disposal the necessary bacteriological equipment, such as platinum wires, stains, culture media, etc., of which they were in great need, and our Medical Officer was instructed to offer all possible assistance in the pursuit of these investigations.

As a result of prolonged search, three dead tarabagans were found on 16-17 September on the field, which on examination showed evident signs of Plague. One set of organs and cultures were sent to our main Laboratory at Harbin and enabled us to confirm the earlier diagnosis of Plague.

These discoveries therefore opened up an interesting line of research, which we hope to make good use of next spring when a scientific expedition will be undertaken in the tarbagan region with a view to settling many problems which are at present puzzling. We shall also be able to determine the question of trapping and killing of these animals, the export of whose fur amounts to nearly one million pieces annually.

6. Among other infectious diseases, Typhus exanthematicus is still endemic among the poorer Russians and Chinese at Manchouli. In the local prison of that city, six cases were reported with two deaths at the end of October. Typhoid Fever was also unusually prevalent at Harbin this autumn, but Dysentery and Simple Enteritis were about normal. Influenza was present in a mild form. Although Small Pox seems to have invaded Shanghai in a virulent form, all cities in Manchuria appeared fairly clear from the infection.

7. The formal opening of the new Union Medical College, Peking, took place in the week 15-22 September, followed by an International Medical Conference, which was attended by large numbers of medical men and women from China, America, Japan, Great Britain, France, Java, Hongkong and other places. This acme of excellence in hospital construction, combining as it does the supreme beauty of Chinese architecture with the completeness and efficiency of western science, was a revelation to most visitors, and I feel sure that no one was more impressed than Mr. John D.

Rockefeller, Jr. who attended the inauguration and through whose generosity this ten million dollar medical college and hospital have been made possible for the youths of China. The annual cost of maintenance amounting to nearly one million dollars will also be met by the Rockefeller Foundation.

8. At the request of the Director, I delivered one of the principal addresses, choosing as my subject, "Plague in the Orient, with special reference to the Manchurian outbreaks." Besides the ordinary problems of Plague, I referred to the series of investigations we had made during the last epidemic, including researches upon the action of various antiseptics upon plague sputum, inhalation experiments upon tarabagans, the degree of danger in clothes worn by the sick and in rooms occupied by the sick and dead. A special demonstration on plague was also held, at which I showed specimens obtained from plague postmortems and results of animal experiments.

I also attended the Conference of Japanese doctors held on 23-24 September at Port Arthur and read a paper on "Pathological Findings in the second Manchurian Epidemic of 1921."

At the special request of Dr. Shiga, Director of the Government Medical College of Seoul, I journeyed to Chosen and gave an address before the Japanese Medical Congress on "Some New Problems in Plague Pneumonia" and suggested how the question of Protective Inoculation and Immunity might be dealt with in this extremely fatal disease.

Throughout this tour, I was received with the greatest courtesy not only by our professional brethren but also by the Japanese officials from the Governor General downwards. To one and all, I am much indebted for much information regarding the present condition of medical progress in the Far East.

9. Thanks to the courtesy of the Manchouli Municipality, we have been able to acquire four large blocks of substantial buildings for use as our Hospital in that city. These same premises were used during the plague epidemic for patients, but have been thoroughly disinfected and repaired for our present use since June. We have appointed a permanent medical officer in charge of that Hospital.

10. We have also made arrangements with Mr. Skidelsky, lessee of the coal mines of Dalainor, to station a Chinese medical officer chosen by us to assist in the medical work there. During the last epidemic, the Russian doctor in charge was obliged to rely upon our Chinese doctors lent to the mines, as he found much difficulty in dealing with the

6000 workmen resident there. The pay of this new medical officer will be defrayed by the mine authorities.

11. In order that the lessons of the present epidemic may not be lost, I have prepared a comprehensive plan for dealing with any future epidemic that may arise even more effectively than we have been able to do in the past. For this purpose, I have proposed the following:—

a. One medical station at Hailar with facilities for bacteriological work and an isolation station for 400 persons.
b. One quarantine station at Manchouli for 500 persons.
c. Isolation barracks for 100 at Dalainor, already erected.
d. One quarantine camp on the north side of Harbin aross the River Sungari for 800 persons.
e. One isolation camp for 900 persons together with adjoining hospital at Changchun.

Besides the above, measures will also have to be undertaken at Chefoo to provide for suspected vessels arriving from Vladivostock and Japan ports bringing plague or cholera cases, and also at Antung on the boundary of Korea for protection against cholera from Japan.

Money devoted to such institutions will, in my opinion, be well spent, since it serves as insurance against the loss of millions of dollars in business and thousands of human lives whenever an outbreak of plague or cholera occurs. In the eyes of the world, we shall also prove that we are fulfilling the progressive needs of the times.

12. Quarantine Regulations on the Rivers Sungari and Amur were enforced in April for the first time in Harbin and other ports under our control in North Manchuria since these were opened to trade. Fortunately, although some anxiety was caused by two suspected deaths occurring on board the first two steamers that left Harbin towards the end of the plague epidemic, no actual infectious cases were found by our Medical Officers stationed at the ports and Customs stations. Medical examination of steamers was stopped in the middle of May, when the plague in Harbin had been totally suppressed.

13. Most of our hospitals were closed to ordinary patients for four to five months on account of the plague epidemic, and so the records for 1920-21 have shown a diminution in this respect. The following are the figures of stations as compared with the preceding two years.

	1920-21.	*1919-20.*	*1918-19.*
Harbin	5,058	11,468	10,474
Taheiho	4,649	6,585	6,513
Sansing	3,631	4,694	3,677
Lahasusu	3,229	1,885	1,089
Newchwang	3,225	3,230	——

The above do not include Customs, Post Office, Government employes and private patients.

14. In spite of plague and much political uncertainty, the material prosperity of Harbin and other cities in Manchuria continues. Houses seem to be as scarce and rents as high as ever, but the maximum of inflated prices has apparently been reached, and the next year may see a gradual return to normal times. The Chinese authorities are opening up a new section of the city further east of the Ssu Chia Tzu extension as well as on the north side of the river where the Harbin-Taheiho Railway is expected to start from. A new macadamised road leading from the main street to the front gate of the Hospital was completed this spring. The contract for an electric tramway in Harbin and suburbs which will run past the front of our Hospital has been awarded to a Chinese Company, and there is every evidence that with more rapid and cheaper communication the population of this city will reach half a million within the next five years. Similar improvements have been noticed in other cities in Manchuria, notably Antung, Mukden, Dairen and Changchun.

15. The following comprise the *personnel* of the Service during the past year:—

Dr. Wu Lien Teh, Director and Chief Medical Officer.
Mr. R. C. L. d'Anjou, (Commissioner of Customs) Lay Director and Treasurer.
Dr. J. W. W. Chun, M.B., B.C. (Cantab) Senior Medical Officer, Harbin.
Dr. R. Pollitzer, M.D., (Vienna) Bacteriologist.
Dr. Ando Chu, M.B., Ch. B. (Edin.) Senior Medical Officer, Newchwang.
Dr. Tang Tsung Mien, Resident Medical Officer, Taheiho.
Dr. Lin Chia Swee, on leave studying at the Kitasato Institute, Tokio.
Dr. Shih Chi Liang, Resident Medical Officer, Sansing.
Dr. Y. M. Kwan, Resident Medical Officer, Manchouli.
Dr. Chen Ching, Resident Medical Officer, Harbin.
Dr. Hsuan Wei Kun, Second Resident Medical Officer, Harbin.

Dr. Li En Chang, Resident Medical Officer, Lahasusu.
Mrs. Chen Chin Tsai, Female Deputy Medical Officer, Taheiho.
Miss Chen Chi-ching, Matron, Harbin.
Miss Kung Sui Chen, Chief Nurse, Newchwang.
Mr. Chao Ping Wen, Senior Dispenser, Harbin.

Dr. E. B. Young, Resident Medical Officer, Newchwang, left our Service in September to accept a teaching post at the Government College of Engineering, Tongshan, and was succeeded by Dr. Ando Chu, a graduate of Edinburgh University. Dr. Ling Ting Fan, who has been with us for eight years, left in January 1921 to take up private practice.

16. In conclusion I wish to express my best thanks to the Chinese Government, Chinese Eastern, and South Manchurian Railways for facilities granted me in the prosecution of my work. Our relations with the Japanese and Russian Medical Officers of their respective Railways have been of a most cordial nature. I am also grateful to the Customs officers at various stations in Manchuria for frequent assistance rendered to members of our Service in the course of their duty.

I have the honour to be,
Wu Lien Teh.
Director and Chief Medical Officer.

SUMMARY OF THE HARBIN HOSPITAL REPORTS FROM JANUARY 1918 TO SEPTEMBER 1921.

1. In March 1918, a good deal of work was done towards the prevention of pneumonic plague and typhus. At that time, plague was raging in Shansi, and a typhus epidemic gripped Suifenho, on the eastern terminus of the Chinese Eastern Railway, so that the possibility of invasion of Manchuria by these dread diseases was generally regarded with alarm. Moreover, typhus was prevalent among the Russians in Siberia whence refugees were continually pouring into Manchuria, so that some cases were diagnosed in Harbin city itself.

Our staff co-operated with the Chinese authorities and the railway doctors in the examination of railway passengers, the sanitary inspection of the town, the provision of hospital accomodation for the sick and quarantine quarters for the contacts, as well as conducting the dissemination of knowledge on the nature, methods of prevention of typhus, and other necessary public health measures.

It is satisfactory to relate that no spread of this disease occurred in Harbin.

Similar work was undertaken in February 1919, and in March 1920, each time when typhus threatened Harbin, altogether with happy results.

2. In May 1918, an epidemic of influenza occurred in Manchuria and later in China proper. In Harbin, it was very prevalent so that 40 per cent of the population was attacked. The noticeable feature, however, was the mild nature of the disease so that the mortality was low.

In November of the same year, an influenza pandemic appeared in the whole world, involving Asia, Europe and America. This time, in Harbin as elsewhere, the type was much more virulent causing pneumonia and death in large numbers.

An infectious disease like influenza when involving the upper respiratory tract is exceedingly difficult to control, though efforts were made to prevent the aggregation of people, and to make known the nature of the sickness with recommendations how to avoid it.

From all accounts, it appeared that death from influenza was not so numerous among the Chinese population as in foreign countries, nor was our hospital crowded with influenza patients.

In November 1919, another epidemic of mild influenza attacked Harbin. Though large numbers of cases were heard of, the commercial life was not interfered with in the same way as in 1918.

3. In the summer of 1919, the weather was unusually hot and dry. Enormous numbers of flies pestered the town, so that when cholera invaded the Philippines and Foochow and travelled northwards, Harbin was speedily assailed. Altogether 4903 deaths from cholera were recorded in this city. In our hospital, 1962 cases were treated mainly with hypertonic saline intravenous injections, resulting in a low mortality of 14.11 per cent.

4. In the summer of 1920, a public health campaign was conducted in the city with the help of the American Y.M.C.A. Public health lectures, cinema shows, and lantern slide exhibitions were given once weekly for a period of four months. These lectures and exhibitions were held mostly in the open air for the benefit of "the man in the street," but they were also shown in the merchants' guild and schools in order to reach the educated class. On such occasions one of our doctors gave short lectures illustrated by suitable lantern slides dealing with many aspects of sanitation and hygiene.

5. In January 1921, pneumonic plague found us prepared, and the situation was well handled, though the population had increased from 80,000 in 1910 to 135,000 in 1919, and from that to 300,000 in 1921. Our hospital admitted 1457 cases of which 1310 were plague, during a period of four months.

6. It is proposed to deal here with some aspects of the statistics and treatment of the in-patients during these four years.

Medical cases admitted	293
Surgical ,, ,,	552
Diseases of the eye	16
Diseases peculiar to women	6
	867

Males	791
Females	76
	867

As will be noted, these cases comprised only ordinary hospital patients. Cholera and plague patients have not been included. A summary of these 867 cases and a list of 370 operations performed under anaesthesia are appended.

Of the 867 cases admitted, there were 82 deaths. In looking at the figures, one is struck with the remarkably low mortality of typhus among the Chinese, as it is 2 in 40 or 5 per cent.

In small pox also, it is only 1 in 6. In typhoid, on the other hand, the mortality is 15 in 49. In pneumonia, it is 6 in 24, and in phthisis, it is 8 in 29.

Appendicitis was encountered once in four years. This occured in a man of 30 years of age who had an appendix abscess which was opened and drained. He made a good recovery.

Foreign bodies in bladder.

There were three such cases. One man introduced a piece of straw per urethra, the second man introduced a used bullet and the third man a piece of lead measuring 5 inches long. They all did this because friends told them that their gonorrhoea would be cured by such measures. The straw was partially in the urethra and so was removed by urethrotomy. The bullet and lead piece were taken out by the supra-pubic route. All the patients recovered.

Three cases of ovarian Cyst.

(a) Mrs. Dien, age 30; multipara, complained of an abdominal swelling which appeared a year ago. She was a small thin woman of pale complexion. There was free fluid in the abdomen and an irregular mass could be felt rising from the pelvis up to the level of the umbilicus. This mass was felt to be connected with the uterus.

On operation, the mass was found to be cystadenoma of the right ovary. On removal, it weighted 5 lbs. The patient made an uneventful recovery.

(b) A married woman of 35, mother of a child, was admitted with a history of gradual swelling of abdomen for 3 years. She was treated by Chinese doctors in Sansing, where she lived, and though relieved by tapping, the swelling again appeared. The condition became so serious that she could get short snatches of sleep only.

On admission she appeared to be a healthy woman, fairly well nourished, but with a large abdomen measuring 42 inches round. Other organs were healthy.

On operation, an incision 7 inches was made from the symphysis pubis upwards. There was some free fluid in the abdomen. An ovarian cyst was found and tapped, when 4 basins of fluid were removed, and the tumour was delivered out of the wound. The tumour rose from the left side of the uterus and it was from here that the broad ligament was clamped and cut. When removed, the tumour weighed 9½ lbs. It had a round disc shape with a diameter of 8 in. and a thickness of 3½ inches.

The recovery was rapid and she left the hospital with a sound scar.

(c) A married woman of 31, was admitted with a history of gradual swelling of the abdomen for 3 years.

She was thin and pale. There was very little fluid in the abdomen, but a large nodular tumour could be felt extending from the pelvis to the diaphragm.

On operation, the omentum was found to be adherent extensively to the upper part of the mass. After ligaturing and dividing the adhesions and tapping the tumour, it was delivered out of the wound and removed from the left side of the uterus. The fluid removed by tapping measured one bucket and weighed 25 lbs. while the tumour substance weighed another 25 lbs. so that whole weighed 50 lbs. When the patient recovered, she was weighed and found to be 86 lbs.

She suffered meteorism for 2 days and when this was relieved, the recovery was uninterrupted.

7. *A Fatal Case of Tetanus.*

The story about to be related presents a moral. For a temperance meeting, it could have been used as a warning to all who err on the side of Bacchus; further, it is all the more valuable in that it is thoroughly authentic.

It is connected with a Shantung man named Tsur, aged twenty-six who lived up in the hills (裏山) along the Chinese Eastern Railway line to Vladivostock about three hundred li east of Harbin. He was caretaker of a house belonging to the railway, and also occasionally helped to cut down trees for firewood in the forest along the line.

On or about the 11th January, after the day's work, he drank two catties of kaoliang wine which is a favourite among the poor class of Shantung people here. Under the influence of wine, he took with him ten catties of opium and went out of the house with the idea of tramping to Harbin. It is quite usual for people to bring opium to towns from the country, for opium is largely cultivated in the country, and when brought to the town, it can be sold profitably.

The man started on his journey in the snow. Soon he felt warm and presently hot, also he was not sure where he was First he threw away the packet of opium, then he took off his rawhide shoes, which are lined with fine *wula* straw and are excellent for the protection of the feet against the severe cold of Manchuria. He lost his way and wandered about all night in the bitter cold which would be probably—30° C. At 5 a.m. he managed to reach home all by himself. His comrades found he was suffering from shock, cold, and frozen limbs. After a few days he recovered, but his hands and feet were black with gangrene.

He was brought to our hospital some ten days after the exposure.

On admission, he did not look ill, and did not have fever, but he was filthy, with dirt on his face and matted long queue. His feet was wrapped in fur socks and were moist and gangrenous from the toes to a point just below the malleoli, emitting a bad smell. There were superficial abrasions and blebs containing serum on the dorsum of the feet. The tips of the fingers were also black.

He was thoroughly cleaned up, and his feet were washed with lysol soap, dried, dusted with iodoform-boracic powder, and wrapped up. The usual treatment of gangrene from exposure to cold was adopted, namely the "wait and see" policy. For it has been found that if one waits till the line of demarcation between the healthy and dead tissue becomes clear, then one can simply cut off the dead tissues and trim the bones until the healthy bleeding tissues are reached. The raw surface is allowed to granulate and skin grafted. In this way, more of the limb can be saved and a longer stump secured.

22nd. January.

In the evening, patient began to complain of trismus.

23rd. January.

In the morning the jaw was opened with more difficulty.

Tetanus was diagnosed, though scrapings from the superficial wound of the feet showed no tetanus bacilli, and energetic means were at once adopted to combat the disease.

Amputation of the gangrenous feet was advised, but the patient refused to comply with the suggestion.

In the whole of Harbin, no tetanus antitoxic serum could be obtained, so one had to do without it.

Two c.c. of a five per cent carbolic acid solution were injected intramuscularly every hour, and ten c.c. of fifteen per cent commercial magnesium sulphate solution were injected intravenously straight away.

No noticeable improvement occurred, for toward evening, the muscles of the back of the neck and those of the back became rigid, *risus sardonicus* developed, and tetanic spasm of the muscles of the neck and back appeared every five minutes.

Moreover, though he was exceedingly thirsty through much perspiration, no fluid could be swallowed. Sleep was also impossible.

He was perfectly conscious, however, and his pulse was between 70 and 80, when he was quiet. His temperature, also, was no higher than 95° F.

24th January.

Convulsions were more frequent, now one every minute.

The acid carbolic intramuscular injection was continued hourly 1.30 p.m.

Ten c.c. fifteen per cent magnesium sulphate solution were given intraspinally under chloroform anaesthesia, after with drawing ten c.c. of clear cerebrospinal fluid.

2.30 p.m.

There was no sign of spasms after recovery from chloroform.

Now he took notice of his surroundings, could open his mouth a little wider than before, he could speak more distinctly and swallow milk . The *risus sardonicus* was diminished, and the neck muscles were less rigid.

3.00 p.m.

One spasm occurred, after that he became drowsy and he slept.

The breathing was noticeably shallow, and was chiefly abdominal.

5.30 p.m.

Spasms started again and were not controlled by potassium bromide and chloral. They continued till next morning.
25th. January.

He was thinner and semi-conscious; spasms were frequent. Carbolic injections were repeated as before.

12.00 noon.

Under chloroform, eight c.c. of cerebrospinal fluid were withdrawn by needle. The fluid was found to be distinctly cloudy and when examined afterwards under the microscope, polymorphonuclear cells were seen in abundance. Eight c.c. of fifteen per cent magnesium sulphate solution were again injected intraspinally.

12.45 p.m.

No spasms occurred though patient was semi-conscious. The breathing was even and quiet, and the pulse showed good volume.

Subcutaneous injection of two hundred c.c. of saline solution was given with the view of replenishing the body fluid, and enule milk suppositories were administered every three hours.

6.00 p.m.

Patient never regained complete consciousness since noon, but gradually grew weaker and weaker, and his breathing became slower and slower till he died.

CONCLUSIONS.

1. It is generally recognized that when tetanus developes nine days after infection, the case is as a rule not serious, but in the above case, signs of tetanus appeared on the 11th day, and proved rapidly fatal.

2. As no chemically pure magnesium sulphate could be obtained, the ordinary commercial salt was used. In the "Medical and Surgical Therapy" edited by Sir Alfred Keogh, it was recommended that only chemically pure magnesium sulphate which crystallizes with seven molecules of water may be used, as the commercial salt contains more or less water.

3. The presence of large numbers of polymorphonuclear leucocytes in the cerebrospinal fluid withdrawn on the 15th. January points to inflammation of the meninges, possibly due to the irritating action of the magnesium sulphate.

4. The depressing action of the magnesium sulphate on the central nervous system certainly seems to be powerful as recorded above. The mode of death suggests strongly that some such action had been produced to the detriment of the organism, though the attack of tetanus was manifestly a severe one.

5. It is worth while to quote, however, from the Medical Annual, 1915. "Intraspinal injections of magnesium sulphate, as originally introduced by Meltzer and Auez in America, and to which Kocher in Europe has specially directed attention, sometimes have a beneficial action, mainly by temporarily suspending the functions of the intensely irritable cord. Stromeyer of Jena records a series of five cases treated by repeated intrathecal injections of a fifteen per cent solution of magnesium sulphate, eight c.c. being injected after a preliminary washing out of the normal saline solution. One, or at most two, injections were given. Four patients out of five died, although it must be admitted that in two of them severe pneumonia was also present, which would probably have been fatal independent of the tetanus.....

All five cases after injection with magnesium sulphate showed as constant phenomena, sleep, cessation of tetanic spasms, relaxation of muscular rigidity, diminution of reflexes, and slowing of respiration. Respiratory failure, a danger emphasized by Kocher, did not occur in any of Stromeyer's cases, possibly because of the moderate doses employed. Stromeyer is inclined to increase the dose in future cases."

8. NOTES ON SOME PATIENTS.

a. *Spindle Cell Sarcoma of Arm.*

Jen was a fairly well developed man of forty-four. He stated that six years ago he noticed a swelling of the size of a Chinese wineglass on the outer aspect of the left arm which gave him occasional pain. Three years ago it got to the size of a teacup and from then it has gradually increased in size until it attained the dimensions of 4″ by 3″ with its long axis vertically placed.

On examination a large oval tumor was found on the outer and posterior aspects of the upper part of the left arm. Superficial veins were distended at this region and surrounding areas. The tumor was firm and nodular to the touch and markedly distensile so that at each beat of the heart it could be felt and seen to expand. A loud blowing murmur could be heard over it. It was freely movable laterally but could be felt to be attached to the upper part of the triceps muscle. The left arm below the tumor looked bluish as if it was congested with venous blood. It certainly felt colder than the right arm. The left radial pulse was smaller than the right.

By compressing the left subclavian artery the tumour was but very slightly diminished in size. This fact and also its situation differentiated it from aneurism of the axillary artery. It was thought that the tumour might be dealt with first by tying the third part of the subclavian artery, which was successfully done. The tumour after the operation became a little smaller and lost its expansile quality. In view of the extensive penetration of growth, amputation of the arm at the shoulder joint was suggested, but the patient refused. He begged that something be done as his left arm was much weakened by the presence of the tumour. It was then reluctantly decided to try and excise the tumour three weeks after the first operation. A longitudinal incision was made over it and efforts were made to dissect it out. Profuse hemorrhage was encountered, as the tumour was still very vascular. Before the operation was completed the patient's condition compelled stoppage of further manipulations and the wound was sewn up. The after history was that the edges of the wound became gangrenous and the wound suppurated. The patient went gradually downhill, being weakened by the suppurating wound, and eventually died two months after the operation.

The microscopic examination of the tumour proved it to be spindle-cell sarcoma.

b. *Ankylosis of the Elbow.*

Sung, aged twenty-six, a tiger hunter, told the history that a year ago while stalking a tiger with his father and brothers, it pounced on him and felled him to the ground. It then proceeded to maul him. He tried to ward off the tiger with his left arm, and suffered wounds of the scalp, chest, and forearm in consequence. His companions saved his life by shooting the tiger and took him home. He lay in bed for four months with his left arm straight by his side and was attended by Chinese doctors.

On admission he appeared to be a robust man; he could now get about and was well, except that his left arm was useless because the elbow, wrist, and fingers were all stiff.

The left arm was wasted from the shoulder downwards and was held straight. No pronation or supination was possible and the hand was in the supine position. There was a deep linear scar in the front of the forearm sugesting a healed sinus from a compound fracture. The wrist was disorganized. Scars were to be seen in the front and back of it. The styloid process of the ulna was extremely prominent. The elbow was stiff apparently from disuse. With the view of bending the elbow so that the hand can at least hold a rice bowl to the mouth, an operation was performed on it. Under chloroform, a medial incision was made at the back of the elbow. The olecranon process was chiseled away, the attachment of the triceps muscle divided, and the joint was forcibly flexed. The wound was sutured, and the elbow was kept in a splint and kept in a position of flexion slightly more than a right angle.

The wound healed by first intention and passive movements and massage were soon after started. Three weeks after operation the range of movement was about 45°, the joint was still weak and was curiously shaped like a bent tree, as the curve was so gradual and not angular. The arm was now more useful, for it could help the sound one; it was still very weak, however. But the patient was entirely satisfied. The sequel to this account was that when he returned home with his father, he was stopped by the police in a town some hundreds of li away from Harbin and because of his old wounds he was taken to be a *hunghutze* (bandit); they thought he must have got these wounds from bullets. He was put into prison and his father came back and asked us to help his son. We wrote a letter to the magistrate stating the case as clearly as we could and he was released. Father and son both came back to thank us before departing for home again.

c. *Three Hypertrophied Toes of the Left Foot.*

Chung, who was twenty-two years of age, was born with an enormous foot. The left foot was the offending one, and it is a source of discomfort and worry because of its weight and the fact that he had to have a special shoe made to order for it. For the inner three toes of the left foot were four to five times the size of the corresponding ones on the right. The outer two toes were abnormally small though they were more or less normally formed. The whole of the left foot was one third bigger than the right; the enlargement seemed to begin from a point in the region of the middle of the metatarsal bones downwards. The enlargement involved all the structures from skin to bones. The texture of the skin of the large toes did not appear different, but there was too much subcutaneous tissue. The temperature of the skin was also lower than normal and the circulation was sluggish due to deficient blood-supply. The hypertrophied toes could be moved, though perhaps a little clumsily.

He appeared to walk on the outer edge of the foot.

In order to relieve him of the weight, it was decided to operate on him and to remove the toes. Accordingly, incisions were made above and below the tarso-metatarsal joints, the toes were amputated by disarticulation at these points. The heads of the second and third metatarsal bones were cut off, the redundant subcutaneous fat was trimmed, and the wound sutured and a V-shaped piece of skin was cut off from the bottom flap to make the foot narrower. When the sutures were removed on the seventh day, it was found that an area one and a half inches was gangrenous on the edge of the upper flap due to the poor blood supply. The rest of the wound haeled well.

The gangrenous area eventually granulated and started very slowly to heal. Before it had healed altogether (two months after operation) he insisted on leaving the hospital. The weight was now off and he could walk better. The result of the operation was that the foot which was operated on became three fourth of an inch shorter than the good one, though it was still too broad and too thick.

d. *Lead-Piece in the Bladder.*

Chao, aged twenty-nine, a Taoist priest, came with a history of peculiar interest. He stated that six months ago he had gonorrhea and three months later frequency of micturition; presumably gonorrheal cystitis was present. As a remedy against the troublesome frequency a friend told him to put a lead piece inside the urethra at night. The lead-piece measured five inches, tapering at both ends, and had the thickness of a No. 7 catheter. He did this for a few nights, taking care to have part of the lead outside the urethra. One night the lead-piece slipped up the urethra and got into the bladder while he was asleep. Ever since then he had a sense of weight in the region of the bladder and at the end of micturition there was always some pain. There has been no hematuria. The frequency of micturition has since gradually disappeared.

On examination he was a man of fine physique, of northern stock, and fairly well nourished. He had long hair and a full beard. No signs of disease of other organs were detected. The urine was fairly clear. No blood or pus could be seen by the naked eye. No albumen or sugar was present. Microscopically a few pus cells were seen.

A hard metallic object could be left when passing a sound into the bladder.

At the operation, the bladder was washed and a vertical incision three inches long was made on the abdomen from the pubic bone upward in the middle line. The recti muscles were separated after invading the sheath and the bladder was located by moving a sound in the bladder. The peritoneum was not opened but pushed up out of the way. Two sutures were inserted in the bladder wall with the view of using them as anchors and a small incision was made in it. When the finger was introduced, the lead-piece was found to be doubled up on itself and caked with a deposit which was afterwards found to be phosphatic. Undoubtedly the pliable lead was molded by the strong bladder muscles and made to bend on itself. With a little persuasion it was extracted. The mucous membrane was sewn up with interrupted catgut and the muscle layer with Lembert sutures. The abdominal wall was closed in layers with no drainage. A silver catheter was tied in. After three days it was replaced by a rubber catheter. On the third day the middle of the abdominal wound leaked and some urine escaped. This delayed the healing of the wound considerably but eventually it did heal, and the patient left the hospital six weeks after the operation quite well again.

e. Contractures of the Knee.

In the summer of 1917, large numbers of Chinese coolies were sent back from Russia. They were handed over to the Chinese authorities at the Kirin Bureau in Harbin to be looked after. Many of them passed through Harbin on their way southward. Some were unable to continue their journey due to sickness and were deposited in our hospital. They all had a good deal of rubles with them, and spent lavishly on themselves, having been well paid working at railway construction in Russia.

Those who came were in a pitiable condition and showed great debility and signs of deprivation. They were more or less unclean and emaciated, their skin was dark and of an earthy color; mucous membrane pale, and swollen. Some of them had uncontrollable diarrhoea.

The most interesting and frequent feature was contracture of the knee (one or both sides) due to past rheumatism and disuse consequent to the pain.

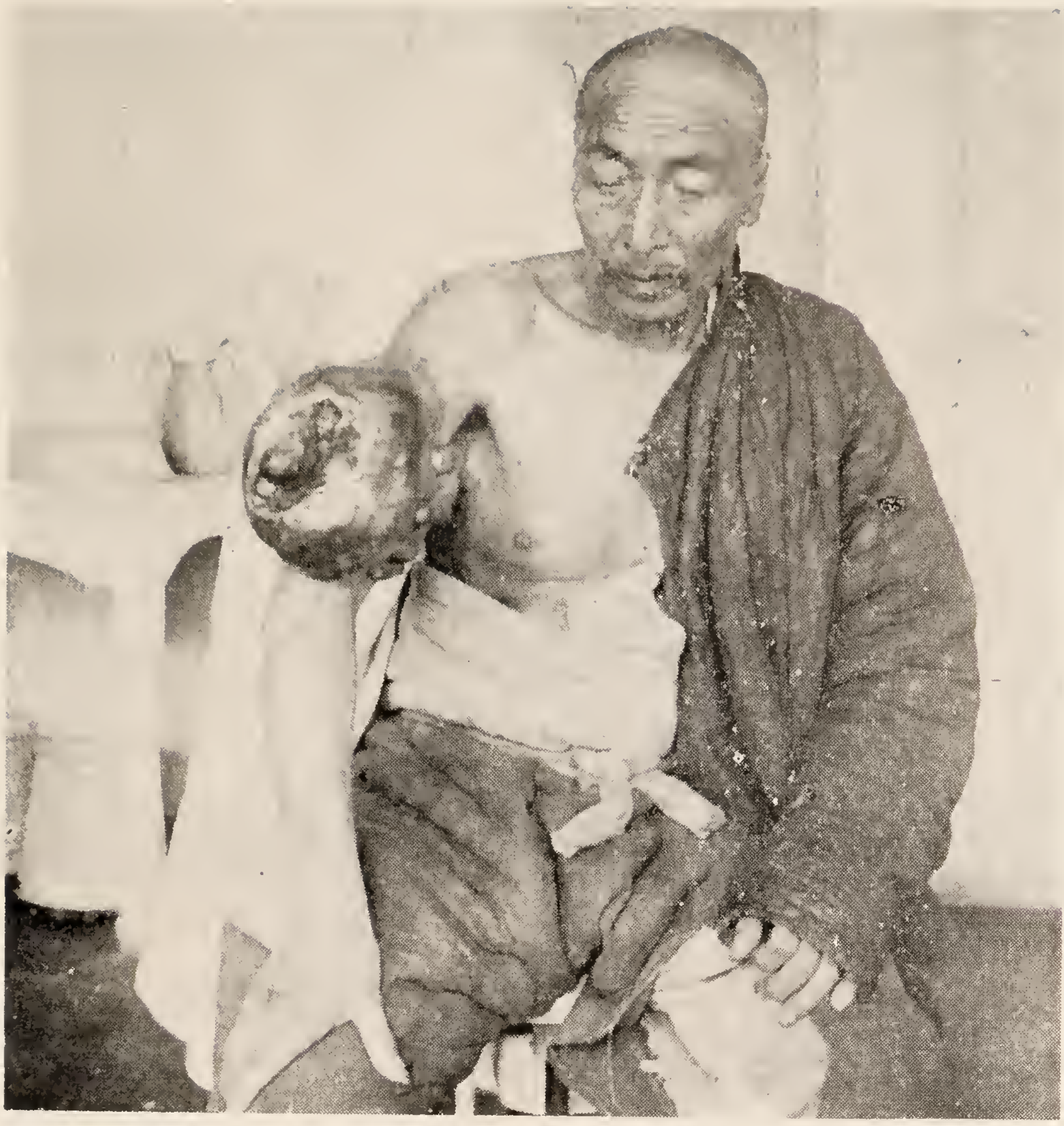
Altogether eleven cases of this nature were admitted. The cause was always alleged to be that they got rhematism while working daily with their feet in water. The length of time from onset till admission averaged about three months. The trouble usually began by the onset of pain and slight swelling of the knees with some temperature.

They just stayed curled up in bed until the attack was over which would last a month or so. The result was that that the knees were flexed and could not be extended; the man could not walk in consequence.

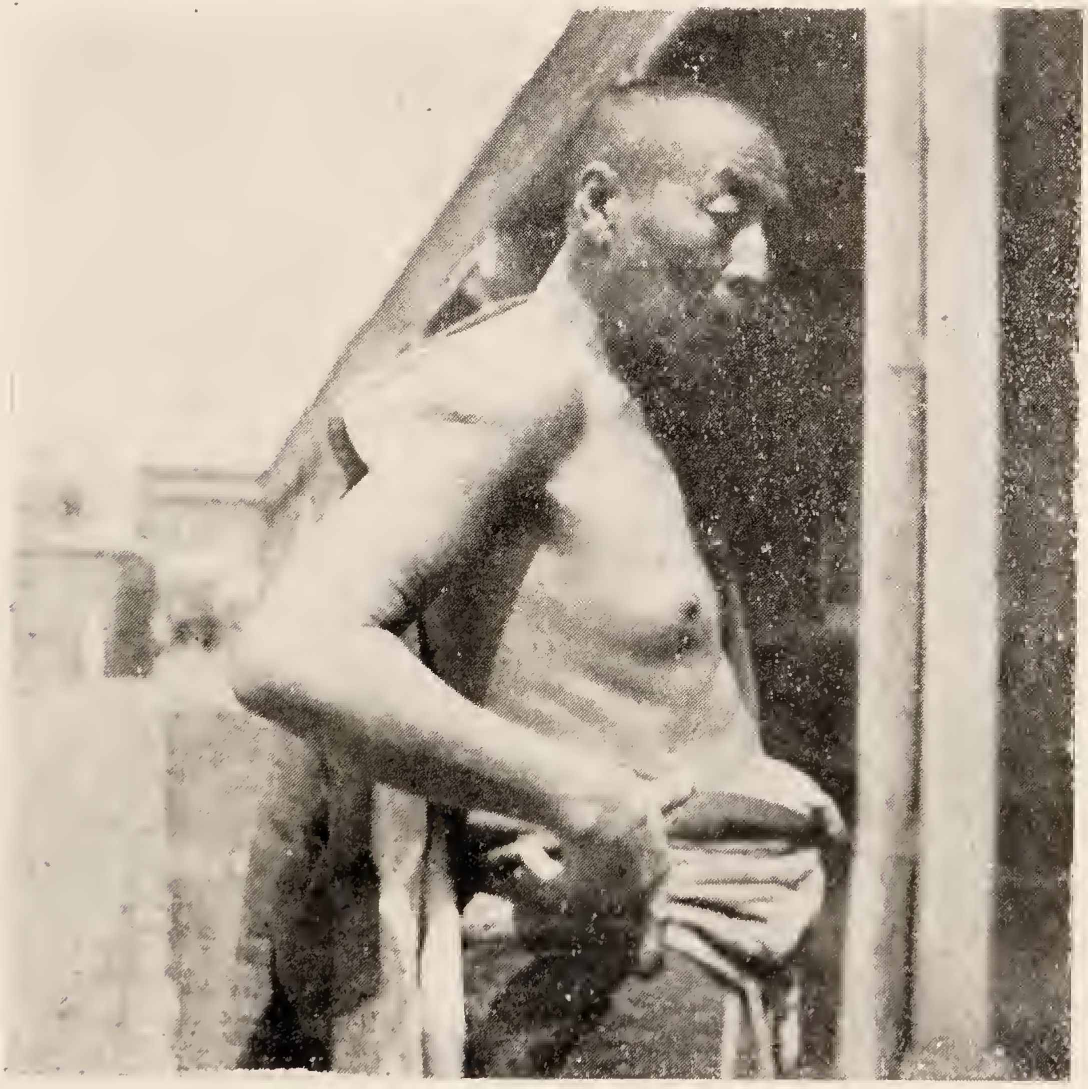
On admission the knees were more or less bent. They showed no signs of inflammation or deformity. The only thing was that the knees could be flexed but could not be fully extended. The flexor tendons were taut when attempt on full extension was made.

With massage, passive movements, strapping on back-splints, the help of crutches, and nutritive feeding, six cases got well; one died due to debility and diarrhoea. The rest (four cases) had to be operated upon to straighten their knees forcibly. A typical case was as follows:

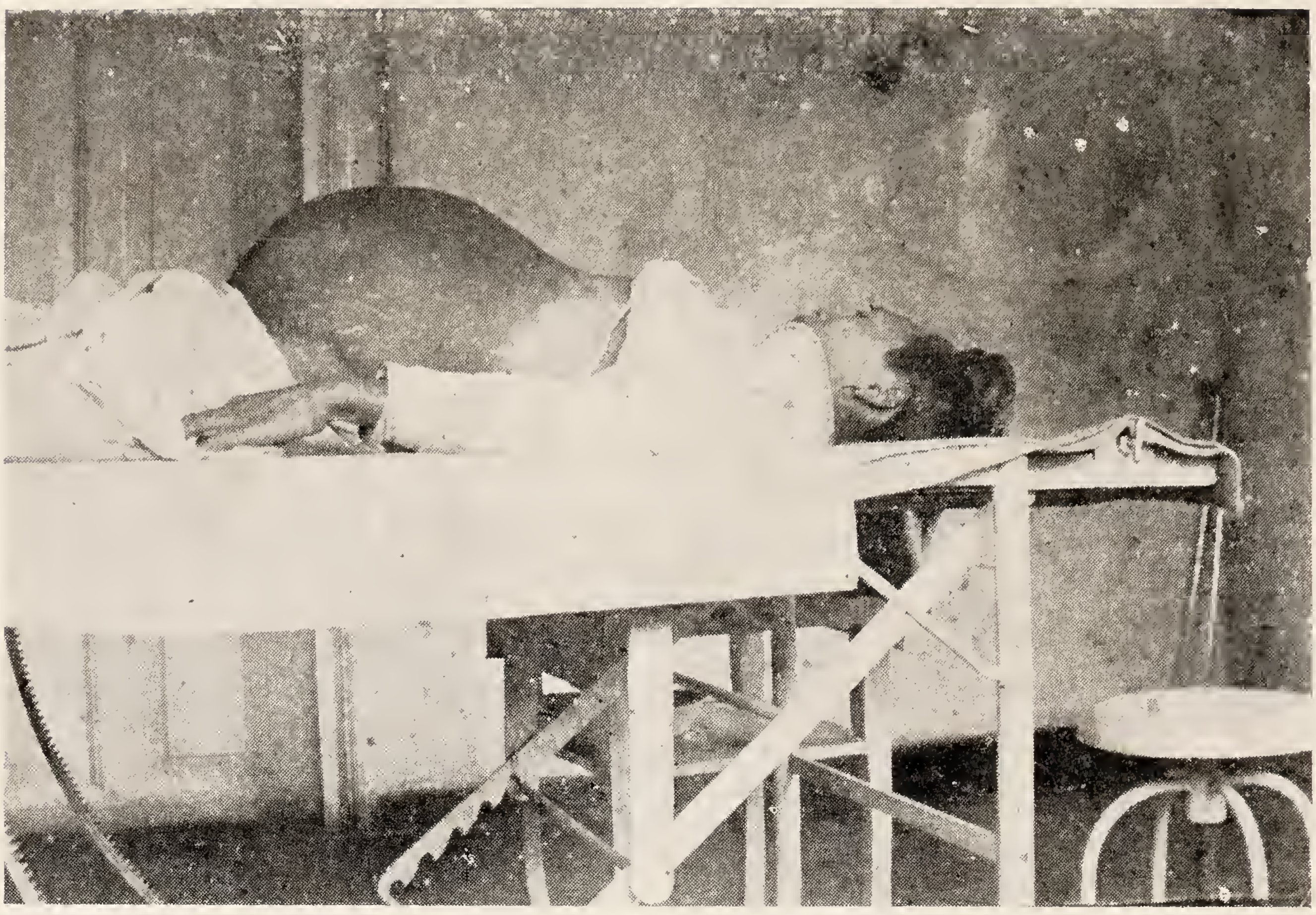
A vertical incision was made over the semi-tendinous tendon, which was lengthened after "Z" operation (Rose and Carless). When completed, the deep fascia was sewed up with catgut, and the skin sutured with horsehair. The Triceps tendon was similarly treated. The knee was then forcibly extended and put on a back-splint. Healing was by first intention. The back-splint was removed at the end of a week,



(a) Soft Fibroma of arm before operation.
上膊軟纖維腫 （手術前）



(a) Soft Fibroma of arm after operation.
上膊軟纖維腫 （手術後）



(a) Cyst adenoma of ovary. Before operation.

卵巢囊腫　（手術前）

(b) Cyst adenoma of ovary, after operation. Wt. of tumour $9\frac{1}{2}$ lbs. besides 4 wash basins of fluid contents.

卵巢囊腫（手術後）囊腫重量九磅半及液體四盤

crutches employed in two weeks or so, and the patient left walking at the end of the third week, highly pleased with himself.

General Notes.

9. It was thought that measurements of some healthy Chinese may prove interesting. The standards of Europe and America have been proved to be different from those of the Chinese by workers connected with the research committee of the National Medical and China Medical Missionary Associations.

In regard to drugs, for instance, the dosage in the foreign pharmacopoeias is calculated on the hypothesis that the adult dose will be administered to an individual weighing about 150 lbs. Now the average Chinese in South China is about one-fifth lighter than this weight, thus involving careful watch when maximum doses of dangerous drugs are being administered. According to our figures obtained by measuring 188 healthy males all of whom came either from Chihli, Shantung or Manchuria, the average man weighs 144.6 lbs. so this question need not worry us.

In examining persons for life insurance it is important to know what is the normal for a Chinese before one can give one's opinion. On looking at the table compiled by us, the average adult northerner is 5′6″ tall, weighs 144.6 lbs. with a chest measurement of 32.1″ , while the European standard for the same height may be put down as, weight 145 lbs. and chest measurement 37.5″.

The comparison between the different standards of healthy Chinese and Europeans is most interesting. It has been shown by the writer in the China Medical Journal (Vol. XXIX No. 3) that the blood of the Chinese varied from that of the European in the smaller percentage of polymorphonuclear cells and the larger percentage of large hyaline and lymphocyte cells. More work may be done profitably in the direction of comparing other features of the blood, different constituents of the urine as well as other anthropological points.

J. W. H. CHUN,
Senior Medical Officer, Harbin.

TABLE SHOWING AVERAGE MEASUREMENTS OBTAINED IN HEALTHY CHINESE IN NORTH CHINA.

Age.	11–20	21–30	31–40	41–50	51–60	Total	Average
No. of cases in each category....	9	86	65	21	7	188	
Height in feet and inches	5′0″	5′6″	5′6.5″	5′6.5″	5′7″	27′6″	5′6″
Weight in pounds.	133	134.5	144.6	156.6	154.5	723.2	144.6
Circumference of chest in inches.	31.8	32.3	32.6	34	33.5	154.5	32.1

Number of ounce weight for each inch of height.

	24.3	20.4	28.6	28.4	28.1	127.8	25.6

HARBIN HOSPITAL. 哈爾濱醫院

CLASSIFIED LIST OF IN-PATIENT DISEASES, JAN. 1918—SEPT. 1921.

住院患者各症之分類表一九一八一月至一九二一九月

Fractures and Dislocations. 骨折及節脫

名稱	*Admitted.*	*Cured or Improved.*	*Same.*	*Died.*
Clavicle 鎖骨	1	1	—	—
Humerus 上膊骨	4	3	1	—
Wrist 腕	1	1	—	—
Ulna 尺骨	1	1	—	—
Thigh 大腿	7	6	1	—
Patella 膝盖骨	0	0	—	—
Tibia & Fibula 脛及腓骨	20	18	1	1
Ankle 踝節	0	0	—	—
Dislocation 關節脫臼	0	0	—	—
Fracture spine 脊柱骨折	3	1	1	1
Jaw 顎	2	2	—	—
Elbow 肘	1	1	—	—
Skull 顱骨	2	1	—	1
Metatarsal bone 蹠骨	4	4	—	—
Os Calcis 踵骨	1	1	—	—
Fracture rib 肋骨折	1	1	—	—
Injuries. 外傷				
Sprain 扭傷	4	3	—	1
Contusions 挫傷	3	3	—	—
Frost bite 凍傷	1	1	—	—
Horse kick 馬踢	0	0	—	—
Bites 咬傷	1	—	—	1
Gun shot 槍彈傷	46	37	8	1
Bomb explosions 炸彈傷	0	0	—	—
Crushes 壓傷	6	4	—	2
Cut throat 頸處自刎傷	0	0	—	—
Burns 火傷	7	7	—	—
Concussion 受震	3	3	—	—
Stabs & wounds 刺及創	40	36	2	2
Scald 湯傷	2	2	—	—
Diseases of Genito-Urinary System. 生殖及泌尿器病				
Nephritis 腎炎	8	5	1	2
Phimosis 包莖	4	4	—	—
Hernio testis 睾丸脫露	1	1	—	—

	Admitted.	*Cured or Improved.*	*Same.*	*Died.*
Urinary fistula 尿管漏	7	3	2	2
Epididymitis 副睪丸炎	1	1	—	—
Rupture urethra 尿管破烈	1	—	—	1
Stricture urethra 尿管狹窄	3	3	—	—
Balanitis 龜頭炎	3	3	—	—
Bubo 橫痃	8	8	—	—
Foreign body in bladder 膀胱內異物	4	3	—	1
Gonorrhoea 淋疾	6	6	—	—
Varicocele 靜脈曲脹	2	2	—	—
Incontinence urine 遺尿症	1	—	1	—
Hydrocele 陰囊水腫	2	—	2	—
Orchitis 睪丸炎	7	—	1	—
Tumours. 瘤				
Fibroma 纖維瘤	9	9	—	—
Sarcoma 肉腫	6	1	3	2
Venereal warts 花柳刺瘤	8	8	—	—
Carcinoma 癌腫	6	—	6	—
Papilloma 刺瘤	3	3	—	—
Epithelioma 上皮癌腫	1	1	—	—
Cyst 囊腫	9	7	2	—
Haematoma 血腫	1	1	—	—
Angioma 血管瘤	1	1	—	—
Condyloma 楊梅濕粒	2	2	—	—
Lipoma 脂肪腫	1	1	—	—
Ovarian cyst 卵巢囊腫	3	3	—	—
Diseases of Nervous System. 神經系病				
Dementia 痴獃	1	1	—	—
Encephalitis 顱腦炎	1	—	—	1
Fright 驚懼	2	—	—	2
Cerebral meningitis 腦膜炎	1	—	—	1
Insomnia 不眠症	1	1	—	—
Epilepsy 癲癇	2	—	2	—
Septic Cases. 化膿症				
Abscesses 膿瘍	31	26	2	2
Ulcers 潰瘍	17	16	1	—
Cellulitis 蜂窩織炎	3	3	—	—
Gangrene 壞疽	13	12	1	—
Eczema 濕疹	1	1	—	—
Tetanus 破傷風	2	—	—	2
Lupus 狼瘡	1	1	—	—

	Admitted.	*Cured or Improved.*	*Same.*	*Died.*
Diseases of Eye. 眼病				
Panophthalmia 眼球炎	1	1	—	—
Entropion 瞼內飜	2	2	—	—
Trachoma 顆粒結膜炎	5	4	1	—
Gonorrhoea Conjunctivitis 淋疾結膜眸	5	5	—	—
Ectropion 瞼外飜	2	2	—	—
Iritis 虹彩炎	1	1	—	—
Diseases of Bone, Muscle and Joints. 骨筋及關節病				
T. B. bone 骨結核	29	27	1	1
Necrosis 骨懷死	4	4	—	—
T. B. joint 關節結核	11	6	2	3
Periostitis 骨膜炎	2	2	—	—
Suppurative arthritis 關節化膿炎	4	2	2	—
Fevers. 熱病				
Typhus 腸發疹窒扶斯	40	38	—	2
Small pox 天然痘症	6	5	—	1
Influenza 流行性感冒	5	4	—	1
Malaria 瘧	4	4	—	—
Catarrhal 加答兒炎	4	4	—	—
Scarlet fever 猩紅熱	1	1	—	—
Tonsillitis 扁桃化腺炎	1	1	—	—
Measles 痲疹	1	1	—	—
Diseases of Alimentary Canal and Digestive System. 消化管及消化系病				
Dysentery 赤痢	17	11	3	3
Typhoid 腸窒扶斯症	49	34	—	15
Enteritis 腸炎	10	8	—	2
Cirrhosis liver 肝變症硬	3	—	3	—
T. B. Peritonitis 腹膜結核	7	2	2	3
Hernia 疝氣	5	5	—	—
Piles 痔核	22	20	2	—
Congenital absence of anus 先天無肛症	2	2	—	—
Fistula in ano 痔漏	73	71	2	—
Fissure anus 肛門裂	3	3	—	—
Constipation 便秘	4	3	1	—
Ulcerative colitis 腸潰瘍	1	—	—	—
Dyspepsia 消化不良	10	10	—	—
Liver abscess 肝膿瘍	4	2	—	2
Catarrhal Jaundice 黃胆症	2	2	—	—

	Admitted.	*Cured or Improved.*	*Same.*	*Died.*
Diseases of Women. 婦人病				
Irregular menses 月經不調	1	—	1	—
Endometritis 子腣內膜炎	2	2	—	—
Fibromyoma uterus 子腣纖維腫	1	—	1	—
Puerperal septicaemia 產褥熱	1	1	—	—
Abortion 流產	1	1	—	—
Diseases of Circulatory and Respiratory System. 循環及呼吸系病				
Pneumonia 肺炎	24	18	—	6
Empyema 膿胸	2	2	—	—
Mitral 僧帽瓣症	3	—	1	2
Phthisis 肺結核	29	11	10	8
Pleurisy 肺膜炎	7	4	3	—
Bronchitis 氣管枝炎	7	5	1	1
Aortic disease 總脈弓症	1	1	—	—
Laryngitis 咽頭炎	3	3	—	—
Aneurysm aorta 總脈囊	1	—	1	—
Various. 雜症				
Otorrhoea 耳膿炎	2	2	—	—
Pyorrhoea 牙根膿炎	3	3	—	—
Varicose veins 靜脈脹曲	1	—	1	—
Starvation and neglect 餓俘	2	2	—	—
T. B. Gland 腺結核	18	14	3	1
Leprosy 痳瘋	2	—	2	—
Syphilis 梅毒	16	14	2	—
Rheumatism 僂麻質斯	19	18	1	—
Appendicitis 盲腸炎	1	1	—	—
Hare-lip 兎唇	3	3	—	—
Opium Habit 鴉片中毒	4	4	—	—
Parturition 產	7	6	—	1
Gumma 獲膜腫	4	3	1	—
Poison 牽中	1	1	—	—
Deformity 畸形	3	3	—	—
Apoplexy 中風	2	—	—	2
Purpura 紫斑	2	1	—	1
Rupture of spleen 脾破裂	1	—	—	1
No diagnosis 未診斷	8	0	8	—
	867	684	101	82

HARBIN HOSPITAL. 哈爾濱醫院

List of Operations between 1918-21.

手術表一九一八至一九二一年

Amputations. 肢截斷術

Toe	脚趾	2
Fingers	手指	11
Forearm	前膊	1
Foot	足	3
Arm	臂	6
Leg	下腿	16
Thigh	大腿	13
Hand	手	1

Bones and Joints. 骨及關節

Necrosis of bone	死骨	5
Compound fractures	複雜骨折	20
Scraping T. B. bone	刮骨結核	16
Plating Femur	釘接骨股	2
Injecting T. B. Sinus	結核漏注射	1
Draining joint	關節排液	2

Blood Vessels. 血管系

Ligature subclavian artery	鑽骨下動脈結紮	1

Skin Fascia Tendons and Glands. 皮筋鞘肌腱及腺

Abscess	膿瘍	20
T. B. Glands	腺結核	5
Lengthening tendon of knee	伸長膝節肌腱	1
Suturing tendons	縫肌腱	2
Cleaning wounds	潔凈傷	14
Skin grafting	植皮術	1
Perineal fistula	會陰漏	2
Excise gland for examination	割腺檢驗	1

Genito-Urinary. 生殖器及尿道

Circumcision	環狀切包莖	5
Castration	割去睾丸	1

Tumours. 瘤

Fibroma	纖維腫	10
Cyst	囊腫	13
Venereal warts	花柳刺瘤	12
Sarcoma	肉腫	2
Epithelioma lip	唇癌腫	1
Papilloma	癌腫	2
Angioma	脈管瘤	1
Granuloma	肉芽瘤	1
Lipoma	脂肪腫	1
Polypus	鼻茸	1
Cyst of Antrum of Highmore	頰穴瘢	1

Alimentary Canal and Abdomen. 育道及腹

Piles	痔核	13
Fistula in ano	痔漏	78
Ruptured spleen	脾破裂	1
Wound of abdomen	腹傷	1
Hernia	疝氣	4
Catherisation	導尿術	1
Exploratory Laparotomy	剖腹	2
Drain liver abscess	肝膿瘍排膿	1
Colostomy	胴剖術	1
Ovarian cyst	卵巢囊腫	3
Appendix abscess	盲腸膿傷	1
Imperforate anus	先天肛閉	3

Eye. 眼

Ectropion	眼外捲	2
Entropion	眼內捲	2
Excision	取眼球	1

Various. 雜病

Extraction teeth	拔齒術	3
Trephining	圓鋸術	2
Resection of rib	肋骨截斷術	3

Suprapubic cystotomy for foreign body in bladder 脥上剖胱取胱異物	3
Bubo 橫痃	1
Urethrotomy 尿道剖術	3
Varicocele 靜脈脹曲	2
Phagedena 蠶蝕性潰瘍	2
Hydrocele 陰囊水腫	1

Plastic. 成形術

Excision keloid 割除瘢瘤	3
Plastic on ear 補耳缺	1
Hare-lip 兎唇	5
Contracture of fingers 指縮攣	2
Instrumental labour 產箝助產	5
Extraction bullet 鎗彈剔出	12
Examination under choroform 全身麻醉檢驗	3
Intraspinal medication 脊髓注射	2
Needle in hand 針入手	2
Manipulation under chloroform 全身麻醉手術	2
Tonsils and adenoids 扁桃腺及鼻喉腺瘤	2
Total	370

J. W. H. Chun,
(*Senior Medical Officer.*)

CLASSIFIED LIST OF IN-PATIENT DISEASES, JAN. 1918—SEPT. 1921.

1919 Cholera and 1921 Plague Cases not included.

住院患者各症之分類表一九一八年一月至一九二一年九月
虎列拉及鼠疫不在內

	Taheiho Hospital. 大黑河醫院	*Sansing Hospital.* 三姓醫院	*Newchwang Hospital.* 牛莊醫院	*Total.* 總數
Fractures and Dislocations. 骨折及脫節				
Humerus 上膊骨	3	0	0	3
Thigh 大腿	1	0	0	1
Tibia 脛骨	3	0	0	3
Ankle 踝節	1	0	0	1
Dislocation 關節脫臼	3	0	0	3
Fracture of skull 顱骨折	0	0	1	1
Injuries. 外傷				
Sprain 扭傷	1	0	0	1
Contusions 挫傷	1	0	0	1
Frost bite 凍傷	23	0	0	23
Horse kick 馬踢	3	0	0	3
Gun shot 鎗傷	28	0	6	34
Burns 火傷	2	0	0	2
Concussions 受震	1	0	0	1
Stabs and wounds 刺及創	55	9	0	64
Snake bite 蛇咬	0	1	0	1
Foreign body in rectum 肛內異物	0	1	0	1
Diseases of Genito-Urinary System. 生殖及泌尿器病				
Nephritis 腎炎	13	2	0	15
Phimosis 包莖	5	0	0	5
Bubo 橫痃	4	0	0	4
Gonorrhoea 淋疾	1	0	0	1
Hydrocele 陰囊水腫	3	0	0	3
Orchitis 睪丸炎	3	0	0	3
Tumours. 瘤				
Fibroma 纖維腫	6	0	0	6
Carcinoma 癌腫	1	0	0	1

	Taheiho Hospital. 大黑河醫院	*Sansing Hospital.* 三姓醫院	*Newchwang Hospital.* 牛莊醫院	*Total.* 總數
Diseases of Metabolism. 新陳代謝症				
Beri-beri 脚氣	7	0	0	7
Diseases of Nervous System. 神經系病				
Aphasia 失語症	1	0	0	1
Dementia 癡獃	0	0	1	1
Encephalegia 顳腦痛	2	0	0	2
Hemiplegia 半癱	2	0	0	2
Epilepsy 癲癇	2	0	0	2
Neuritis of leg 小腿神經炎	1	0	0	1
Neurasthenia 神經衰弱	1	0	0	1
Septic Cases. 化膿病				
Carbuncles 癰	8	0	0	8
Abscesses 膿瘍	13	0	0	13
Ulcers 潰瘍	3	0	3	6
Cellulitis 蜂窩織炎	14	0	0	14
Gangrene 壞疽	1	1	0	1
Anthrax 獸疔	1	0	0	1
Diseases of Eye. 眼病				
Pterygium 翼狀贅片	2	0	0	2
Cataract 白內障	2	0	0	2
Entropion 瞼內翻	5	0	0	5
Trachoma 顆粒結膜炎	6	0	0	6
Gonorrheal conjunctivitis 淋毒性結膜炎	5	0	4	9
Iritis 虹彩炎	1	0	4	9
Staphyloma 葡萄腫	6	0	0	6
Diseases of Bones, Muscles and Joints 骨筋肉及關節病				
T. B. bone 骨結核	8	0	0	8
T. B. joint 關節結核	7	0	0	7
Periostitis 骨膜炎	1	0	0	1
Fevers. 熱病				
Typhus 發疹窒扶斯	18	0	0	18
Small pox 天然痘症	2	0	1	3
Influenza 流行性感冒	17	2	0	19
Malaria 瘧疾	2	0	0	2
Tonsillitis 扁桃腺炎	1	0	1	2
Diphtheria 實扶的里	0	0	1	1
Tetanus 破傷風	0	0	1	1
Parotitis 耳下腺炎	0	0	1	1
Scarlet fever 猩紅熱症	0	0	2	2

1. July 1920-June 1921.

	Taheiho Hospital. 大黑河醫院	*Sansing Hospital.* 三姓醫院	*Newchwang Hospital.* 牛莊醫院	*Total.* 總數
Diseases of Alimentary Canal and Digestive System. 消化管及消化系病				
Cholelithiasis 胆結石	0	0	1	1
Dysentery 痢疾	6	0	1	7
Typhoid 腸窒扶斯症	6	0	2	8
Enteritis 腸炎	1	0	0	1
Hernia 疝氣	7	0	0	7
Piles 痔疾	4	0	0	4
Fistula in ano 痔漏	3	0	0	3
Fissure anus 肛門裂	2	0	0	2
Constipation 便秘	2	0	0	2
Dyspepsia 消化不良	8	0	0	8
Cirrhosis 肝硬變	0	0	1	1
Diarrhoea 瀉	0	0	7	7
Diseases of Circulatory and Respiratory System. 循環及呼吸器病				
Pneumonia 肺炎	18	1	0	19
Mitral 僧帽瓣膜病	1	0	0	1
Phthisis 肺結核	19	0	1	20
Pleurisy 肺膜炎	1	0	0	1
Bronchitis 氣管枝炎	1	0	1	2
Dropsy 水腫	1	0	0	1
Endocarditis 心內膜炎	0	0	1	1
Various. 雜症				
Otorrhoea 耳膿炎	1	0	0	1
T. B. Gland 腺結核	3	0	0	3
Rheumatism 僂麻質斯	9	0	0	9
Appendicitis 炎虫模突起	1	0	0	1
Hare lip 兎唇	3	0	0	3
Scabies 疥	1	0	0	1
Eczema 濕疹	1	0	3	4
Impetigo contagiosa 傳染性膿痂	0	0	3	3
總數 Total	399	16	43	458

SUMMARY OF OUT-PATIENTS TREATED DURING 1917-21, HARBIN HOSPITAL.

哈濱醫院外來患者治療表(一九一七至二一年)

I. *Special Infectious Diseases.* 特別傳染病	*1917.*[1]	*1918.*	*1919.*	*1920.*	*1931.*[2]	*Total.*
a. *Bacterial Diseases.* 細菌病						
1. Typhoid fever 腸窒扶斯症	2	2	3	13	38	58
2. Erysipelas 丹毒	0	0	0	0	0	0
3. Diphtheria 實扶的里	0	0	3	0	0	3
4. Pneumonia 肺炎	0	2	17	8	0	27
5. Influenza 流行性感冒	0	22	10	1	0	33
6. Whooping cough 百日咳	0	0	0	0	4	4
7. Gonococcus Infections 淋菌傳染病	224	104	135	297	30	790
8. Dysentery 赤痢症	86	109	45	278	39	557
9. Cholera 虎列拉	0	1	2	3	0	6
10. Plague 鼠疫症	0	0	0	0	0	0
11. Tetanus 破傷風	0	0	0	0	0	0
12. Leprosy 痳瘋	1	2	0	2	0	6
13. Tuberculosis 肺結核症	73	78	55	277	22	505
b. *Non-bacterial Fungus Infections.* 黴菌傳染症						
c. *Protozoan Infections.* 原生動物傳染症						
1. Malaria 瘧	2	29	2	0	1	34
2. Relapsing fever 回歸熱症	0	0	0	0	0	0
3. Syphilis 楊梅毒	666	387	332	755	218	2358
d. *Metazoan Diseases.* 生原蟲症						
1. Intestinal Cestodes, 縧虫 Tapeworms 帶蟲	0	0	0	5	1	6
2. Diseases caused by Nematodes 線蟲類	0	0	0	1	3	4
3. Parasitic Insects 寄生蟲	0	0	0	0	43	43
e. *Infectious Diseases of Unknown Etiology.* 不知病原傳染病						
1. Small pox 天然痘	0	5	1	2	1	9
2. Chicken pox 水痘	3	0	1	3	0	7
3. Measles 痲疹	0	0	0	0	4	4
4. Scarlet fever 猩紅熱	0	0	0	1	0	1
5. Epidemic Parotitis (Mumps) 流行性耳下膜炎	6	60	1	3	0	70
6. Typhus 發疹窒扶斯	1	27	10	0	0	38
7. Yellow fever 黃熱症	0	0	0	0	0	0
8. Rheumatic fever 僂痲窒斯熱症	0	0	0	0	0	0

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1. Comprised only 9 months from April.
2. ,, ,, 5 ,, up to Sept. (Jan. June, July, Aug. & Sept.)

	1917.	1918.	1919.	1920.	1921.	Total.
9. Acute Tonsillitis 急性扁桃腺炎	44	50	47	38	0	179
10. Acute Catarrhal fever 急性加答兒熱症	53	80	27	31	16	207
II. *Intoxications.* 中毒						
a. *Alcoholism* 酒精中毒	0	0	0	0	0	0
b. *Morphia habit* 嗎啡中毒	0	0	0	1	0	1
c. *Opium Poisoning* 鴉片中毒	0	0	0	2	1	3
d. *Arsenical Poisoning* 亞砒酸中毒	0	0	0	0	1	1
e. *Gold Poisoning* 吞金	0	0	0	0	1	1
f. *Beri-beri* 脚氣	0	0	0	0	0	0
g. *Neosalvarsan Poisoning* 砒素劑中毒	0	0	0	0	4	4
III. *Diseases of Metabolism.* 新陳代謝病						
a. *Rheumatism* 僂麻質斯	438	448	202	328	74	1,490
b. *Diabetes* 糖尿病	0	0	0	0	1	1
c. *Rickets and Scurvy* 軟骨及癰症	0	0	0	0	0	0
IV. *Diseases of the Digestive System* 消化系病	769	635	593	515	165	2,677
V. *Diseases of the Respiratory System* 呼吸系病	573	539	515	247	81	1,955
VI. *Diseases of the Genito-Urinary System* 泌尿生殖器病	52	70	46	57	0	225
VII. *Diseases of the Blood* 血液病	58	76	62	42	5	243
VIII. *Diseases of the Circulatory* 循環系病	61	49	33	39	20	202
IX. *Diseases of the Ductless Glands* 無管腺病	252	239	355	254	7	1,107
X. *Diseases of the Nervous System* 神經系熱	46	71	59	76	59	311
XI. *Diseases of the Locomotor System* 運動系病	21	10	4	6	3	44
XII. *Diseases of the Eye* 眼病	440	284	290	405	178	1,597
XIII. *Diseases of the Skin* 皮膚病	423	487	468	431	43	1,852
XIV. *Diseases of the Nose, Throat, and Ear* 耳鼻咽喉病	292	305	282	258	66	1,203
XV. Diseases of Women 婦人病	766	437	441	277	11	1,932
XVI. *Surgical Cases* 外科	4,392	4,966	4,821	3,786	1,619	19,584
XVII. *Vaccinations* 種痘	23	131	76	197	0	427
XVIII. *Midwifery* 產科	3	2	0	5	0	10
	9,770	9,708	8,938	8,644	2,759	39,819

SUMMARY OF OUT-PATIENTS TREATED DURING 1917-21, TAHEIHO HOSPITAL.

	1917.[1]	1918.	1919.	1920.	1921.[2]	Total.
I. *Special Infectious Diseases.* 特別傳染病						
a. *Bacterial Diseases.* 細菌病						
1. Typhoid fever 發疹窒扶斯	4	16	1	0	12	33
2. Erysipelas 丹毒	4	4	10	7	11	36
3. Diphtheria 實扶里的	0	0	0	9	10	19
4. Pneumonia 肺炎	15	52	47	18	51	183
5. Influenza 流行性感冒	30	105	127	15	22	299
6. Whooping cough 百日咳	0	0	0	0	0	0
7. Gonococcus Infections 淋菌傳染病	299	339	372	307	254	1,671
8. Dysentery 赤痢症	25	50	50	23	7	155
9. Cholera 虎列拉症	0	0	1	0	0	1
10. Plague 鼠疫症	0	0	0	0	0	0
11. Tetanus 破傷風	0	0	0	0	1	1
12. Leprosy 麻瘋	5	1	2	2	0	5
13. Tuberculosis 肺結核	51	138	85	76	81	431
b. *Non-bacterial Fungus Infections.* 黴菌傳染症						
c. *Protozoan Infections.* 原生動物傳染症						
1. Malaria 瘧	107	124	131	82	39	483
2. Relapsing fever 回歸熱症	0	5	0	0	0	5
3. Syphilis 梅毒	290	505	583	821	400	2,599
d. *Metazoan Diseases.* 原蟲症						
1. Intestinal Cestodes, 蜂蟲類 Tapeworms 帶蟲	5	7	8	3	7	30
2. Diseases caused by Nematodes 線蟲類	1	0	0	1	0	2
3. Parasitic Insects 寄生蟲	0	3	3	3	2	11
e. *Infectious Diseases of Unknown Etiology.* 不知病原傳染病						
1. Small pox 天然痘	1	1	3	1	0	6
2. Chicken pox 水痘	0	0	0	0	0	0
3. Measles 疹	0	1	0	0	0	1
4. Scarlet fever 猩紅熱	0	0	0	2	0	2
5. Epidemic Parotitis (Mumps) 流行性耳下腺炎	6	17	15	4	15	57
6. Typhus 發疹窒扶斯	1	24	30	6	6	67
7. Yellow fever 黄熱症	0	0	0	0	0	0
8. Rheumatic fever 僂麻質斯熱症	0	69	0	0	1	70

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1. Comprised only 9 months from April.
2. ,, ,, 9 ,, up to September.

	1917.	1918.	1919.	1920.	1921.	Total.
9. Acute Tonsillitis 急性扁桃腺炎	2	10	7	5	1	25
10. Acute Catarrhal fever 急性加答兒熱症	5	19	11	5	33	73
II. *Intoxications.* 中毒						
a. *Alcoholism* 酒精中毒	0	0	1	0	0	1
b. *Morphia habit* 嗎啡中毒	12	20	52	26	21	131
c. *Lead Poisoning* 鉛中毒	0	0	1	0	0	1
d. *Arsenical Poisoning* 亞砒酸毒	1	0	2	1	0	4
e. *Food Poisoning* 食物中毒	1	0	1	0	0	2
f. *Beri-beri* 脚氣	0	0	0	0	0	0
III. *Diseases of Metabolism.* 新陳代謝症						
a. *Gout* 痛風	0	0	0	0	0	0
b. *Diabetes* 糖尿症	0	1	0	13	0	14
c. *Rickets and Scurvy* 軟骨及[illegible]症	0	0	0	5	0	5
d. *Rheumatism* 僂麻貭斯	6	0	146	332	141	625
IV. *Diseases of the Digestive System* 消化系症	190	323	696	635	396	2,240
V. *Diseases of the Respiratory System* 呼吸系病	38	290	415	523	317	1,583
VI. *Diseases of the Genito-Urinary System* 泌尿生殖器病	91	193	88	61	81	514
VII. *Diseases of the Blood* 血液病	13	34	15	18	19	99
VIII. *Diseases of the Circulatory* 循環系病	6	10	15	5	7	43
IX. *Diseasesof the Ductless Glands* 無管腺病	7	2	15	10	3	37
X. *Diseases of the Nervous System* 神經系病	59	107	84	119	135	504
XI. *Diseases of the Locomotor System* 運動系病	77	111	27	4	25	244
XII. *Diseases of the Eye* 眼病	282	524	1,074	728	408	3,016
XIII. *Diseases of the Skin* 皮膚病	190	328	394	462	289	1,663
XIV. *Diseases of the Nose, Throat, and Ear* 耳鼻咽喉病	73	157	290	256	198	974
XV. *Diseases of the Women* 婦人病	26	9	32	27	33	127
XVI. *Surgical Cases* 外科	1,415	2,829	2,247	2,212	1,222	9,925
XVII. *Vaccinations* 種痘	28	78	58	211	108	483
XVIII. *Midwifery* 產科	3	3	12	9	10	37
Total. ...	3,364	6,509	7,151	7,047	4,366	28,437

SUMMARY OF PATIENTS TREATED DURING 1917-21.

SANSING HOSPITAL.

	1917.[1]	*1918.*	*1919.*	*1920.*	*1921.*[2]	*Total.*
I. *Special Infectious Diseases.* 特別傳染病						
a. *Bacterial Diseases.* 細菌病						
1. Typhoid fever 發疹窒扶斯症	4	1	0	0	0	5
2. Erysipelas 丹毒	0	0	3	0	0	3
3. Diphtheria 實扶的里	0	0	0	0	0	0
4. Pneumonia 肺炎	0	4	0	5	0	9
5. Influenza 流行性感冒	1	10	12	6	32	61
6. Whooping cough 百日咳	0	0	0	0	2	2
7. Gonococcus Infections 痲菌傳染症	38	55	27	45	40	205
8. Dysentery 赤痢症	8	8	23	20	14	73
9. Cholera 虎列拉	0	0	6	0	0	6
10. Plague 鼠疫症	0	0	0	0	0	0
11. Tetanus 破傷風	0	0	0	0	0	0
12. Leprosy 痲瘋	0	0	0	7	0	7
13. Tuberculosis 肺結核	27	26	17	32	13	105
b. *Non-bacterial Fungus Infections.* 黴菌傳染症						
c. *Protozoan Infections.* 原生動物傳染症						
1. Malaria 瘧	5	1	1	2	0	9
2. Relapsing fever 回歸熱症	0	0	0	0	0	0
3. Syphilis 梅毒	26	70	117	185	112	510
d. *Metazoan Diseases.* 蟲症						
1. Intestinal Cestodes 蠏蟲類						
Tapeworms 帶蟲	1	4	2	8	0	15
2. Diseases caused by Nematodes 線蟲類	11	20	4	0	3	38
3. Parasitic Insects 寄生蟲	1	0	8	22	23	54
e. *Infectious Diseases of Unknown Etiology.* 不知病原傳染病						
1. Small pox 天然痘	0	0	0	0	0	0
2. Chicken pox 水痘	0	0	0	0	0	0
3. Measles 痲疹	3	0	0	11	0	14
4. Scarlet fever 猩紅熱	0	0	0	0	0	0
5. Epidemic Parotitis (Mumps) 流行性耳下腺炎	1	0	1	0	9	11
6. Typhus 發疹窒扶斯	1	0	0	0	0	1
7. Yellow fever 黃熱症	0	0	0	0	0	0
8. Rheumatic fever 僂麻質斯熱症	0	1	0	0	0	1

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[1] Comprised only 9 months from April.

[2] ,, ,, 9 ,, up to September.

	1917.	*1918.*	*1919.*	*1920.*	*1921.*	*Total.*
9. Acute Tonsillitis 急性扁桃腺炎	11	16	18	19	30	94
10. Acute Catarrhal fever 急性加答兒熱症	8	12	0	0	0	20
II. *Intoxications.* 中毒						
a. *Alcoholism* 酒精中毒	0	1	0	0	0	1
b. *Morphia habit* 嗎啡中毒	0	2	0	1	0	3
c. *Lead Poisoning* 鉛中毒	0	0	0	0	0	0
d. *Arsenical Poisoning* 亞砒酸毒	0	0	0	0	0	0
e. *Food Poisoning* 食物中毒	0	1	0	1	0	2
f. *Beri-beri* 脚氣	14	0	0	0	0	14
III. *Diseases of Metabolism.* 新陳代謝病						
a. *Rheumatism* 僂麻質斯	1	77	102	102	89	371
b. *Diabetes* 糖尿症	3	2	18	25	17	65
c. *Rickets and Scurvy* 軟骨及瘇症	1	0	0	0	0	1
IV. *Diseases of the Digestive System* 消化系病	236	230	178	307	272	1,223
V. *Diseases of the Respiratory System* 呼吸系病	213	233	110	135	94	795
VI. *Diseases of the Genito-Urinary System* 泌尿生殖器病	22	60	33	0	0	115
VII. *Diseases of the Blood* 血液病	0	7	0	0	3	10
VIII. *Diseases of the Circulatory* 循環系病	34	43	36	31	24	168
IX. *Diseases of the Ductless Glands* 無管腺病	7	5	2	1	0	15
X. *Diseases of the Nervous System* 神經系病	73	73	9	19	4	178
XI. *Diseases of the Locomotor System.* 運動系病	92	25	9	2	4	132
XII. *Diseases of the Eye* 眼病	283	354	317	332	201	1,487
XIII. *Diseases of the Skin* 皮膚病	258	305	28	540	334	1,725
XIV. *Diseases of the Nose, Throat, and Ear* 耳鼻咽喉病	57	68	87	31	33	276
XV. *Diseases of Women* 婦人病	35	43	15	21	45	159
XVI. *Surgical Cases* 外科	2,224	2,068	1,606	2,165	1,205	9,268
XVII. *Vaccinations* 種痘	2	20	15	17	3	57
XVIII. *Midwifery* 產科	1	0	0	0	1	2
Total. ...	3,702	3,845	3,064	4,083	2,606	17,300

SUMMARY OF OUT-PATIENTS TREATED DURING 1917-21, LAHASUSU HOSPITAL.

	1917.	*1918.*	*1919.*	*1920.*	*1921.*	*Total.*
I. *Special Infectious Diseases.* 特别傳染病						
a. *Bacterial Diseases.* 細菌病						
1. Typhoid fever 發疹窒扶斯	3	1	0	0	0	4
2. Erysipelas 丹毒	1	5	0	0	2	8
3. Diphtheria 實扶的里	2	2	0	0	0	4
4. Pneumonia 肺炎	3	7	0	4	33	47
5. Influenza 流行性感冒	1	2	27	536	11	577
6. Whooping cough 百日咳	2	5	0	6	6	19
7. Gonococcus Infections 淋菌傳染病	6	12	9	30	98	155
8. Dysentery 赤痢症	16	6	17	10	58	107
9. Cholera 虎列拉症	3	2	0	0	0	5
10. Plague 鼠疫症	0	0	0	0	0	0
11. Tetanus 破傷風	0	0	0	0	0	0
12. Leprosy 痲瘋	0	0	0	0	0	0
13. Tuberculosis 肺結核	23	8	19	19	6	75
b. *Non-bacterial Fungus Infections.* 黴菌傳染症						
c. *Protozoan Infections.* 原生動物傳染症						
1. Malaria 瘧	9	3	0	1	4	17
2. Relapsing fever 回歸熱症	1	1	0	0	26	27
3. Syphilis 梅毒	37	45	24	79	145	330
d. *Metazoan Diseases.* 蟲症						
1. Intestinal Cestodes 蠊蟲類 Tapeworms 帶蟲類	9	6	17	0	5	38
2. Diseases caused by Nematodes 線蟲類	3	0	0	0	0	3
3. Parasitic Insects 寄生蟲	1	4	0	6	4	15
e. *Infectious Diseases of Unknown Etiology.* 不知病原傳染症						
1. Small pox 天然痘	2	1	3	0	0	6
2. Chicken pox 水痘	3	0	0	0	0	3
3. Measles 痲疹	5	1	5	0	4	15
4. Scarlet fever 猩紅熱	2	3	0	0	0	5
5. Epidemic Parotitis (Mumps) 流行性耳下腺炎症	4	2	9	1	17	33
6. Typhus 發疹窒扶斯	6	3	0	0	0	9
7. Yellow fever 黃熱症	1	2	0	0	0	3

	1917.	*1918.*	*1919.*	*1920.*	*1921.*	*Total.*
8. Rheumatic fever 僂痲質斯熱症	22	11	0	10	5	48
9. Acute Tonsillitis 急性扁桃腺炎	10	5	0	1	19	35
10. Acute Catarrhal fever 急性加答兒熱症	7	3	0	0	1	11
II. *Intoxications.* 中毒						
a. *Alcoholism* 酒精中毒	4	1	0	0	0	5
b. *Morphia habit* 嗎啡中毒	6	2	0	0	0	8
c. *Lead Poisoning* 鴉片中毒	0	0	0	0	2	2
d. *Mercuric Poisoning* 水銀中毒	0	0	0	0	11	11
e. *Food Poisoning* 食物中毒	0	2	0	1	9	12
f. *Beri-beri* 脚氣	5	1	0	0	4	10
III. *Diseases of Metabolism.* 新陳代謝病						
a. *Rheumatism* 僂痲質斯	5	17	10	12	45	89
b. *Diabetes* 糖尿症	7	5	0	0	3	15
c. *Rickets and Scurvy* 軟骨及麵症	0	1	0	0	9	10
IV. *Diseases of the Digestive System* 消化系病	47	30	0	69	209	355
V. *Diseases of the Respiratory System* 呼吸系病	28	12	0	29	73	142
VI. *Diseases of the Genito-Urinary System* 泌尿生殖器病	23	7	0	0	9	39
VII. *Diseases of the Blood* 血液病	34	15	0	0	3	52
VIII. *Diseases of the Circulatory* 循環系病	16	8	0	2	5	31
IX. *Diseasesof the Ductless Glands* 無管腺病	68	19	0	6	1	94
X. *Diseases of the Nervous System* 神經系病	22	8	0	2	0	32
XI. *Diseases of the Locomotor System* 運動系病	6	6	0	0	0	12
XII. *Diseases of the Eye* 眼病	46	26	32	68	126	298
XIII. *Diseases of the Skin* 皮膚病	46	48	28	48	105	275
XIV. *Diseases of the Nose, Throat, and Ear* 耳鼻咽喉病	39	15	21	22	83	185
XV. *Diseases of Women* 婦人病	68	30	30	23	48	199
XVI. *Surgical Cases* 外科	173	218	96	722	457	1666
XVII. *Vaccinations* 種痘	17	9	0	113	21	160
XVIII. *Midwifery* 產科	0	0	0	0	1	1
	842	620	347	1820	1673	5302

RESUME OF THE WORK OF THE MANCHOULI HOSPITAL, (1921-22).

As a preliminary note, it should be mentioned that Manchouli is the western frontier town of Manchuria province and the connecting link between Siberia and China. Any outbreak of infectious disease such as plague and typhus in the former land is liable to threaten the China *via* this frontier town.

The Russian political situation has been for the past years most turbulent, rendering public health measures impracticable, and enhancing the danger of invasion of her neighbours by infectious diseases. Moreover, the constant inter-communication by rail and road facilitate and accelerate the spread of epidemic infections.

With the object of controlling such a grave situation, the North Manchurian Plague Prevention Service decided to establish an Anti-plague Hospital in Manchouli and appointed Dr. Y. M. Kwan as Medical Officer in May 1921 i.e. towards the end of the pneumonic plague epidemic. Dr. Kwan worked for four months to equip and arrange the three blocks of buildings placed at his disposal and formally opened the hospital in October. These blocks were given by the Manchouli Municipality. The first block was maintained for infectious diseases, the second was fitted up with a laboratory, operating room, dressing room, dispensary, etc., and the third was for the living quarters of the staff.

Clinical work. One of the measures for combating a plague epidemic was the cremation of corpses. This was not understood by the local people and some ill-feeling was aroused. The merchant class also was much moved and considered the measure barbarous and against tradition. Thus rumours were spread against the hospital, and the public looked upon it with suspicion. It may be realized then that at the beginning very few patients attended but gradually we gained their confidence, and so from March 1922 onwards, we can often count as many as 20 patients per day. The following records show the variety and numbers of the sick for the first half of 1922.

1. Specific infections diseases.	
A. Bacterial Disease.	
1. Typhoid fever	8
2. Erysipelas	4
3. Pneumonia	3
4. Influenza	5
5. Gonococcus infections	70
6. Dysentery	13
7. Tuberculosis	196
B. Protozoan Infections.	
1. Malaria	1
2. Syphilis	73
C. Metazoan Diseases.	
1. Intestinal Cestodes	1
D. Infectious Diseases of unknown Etiology.	
1. Measles	6
2. Parotitis	1
3. Rheumatic fever	1
4. Acute Tonsilitis	3
2. Intoxications.	
1. Morphia Habit	2
3. Diseases of Metabolism.	
1. Rheumatism	7
4 *Diseases of Digestive System*	93
,, ,, Respiratory System	40
,, ,, Genito-urinary System	11
,, ,, Blood	1
,, ,, Circulatory System	5
,, ,, Nervous System	20
,, ,, Eye	156
,, ,, Skin	155
,, ,, Nose, Throat and Ear	14
5. Surgical Cases	254
6. Vaccination	11
Total	1,165

It may be noticed that tuberculosis heads the list, being 16.8% and syphilis comes second with 6.3%

Examination of corpses. We arranged with the authorities to conduct post mortem examinations of all corpses before burial could be allowed. This was done in order to ascertain the causes of death and to feel the pulse of the health of the community, as it were. In this way, epidemic diseases may be detected right at the beginning.

A table of such examinations during the period August 1921 to June 1922 is appended:—

	1921.					1922.						
	August	September	October	November	December	January	February	March	April	May	June	Total
Tuberculosis (Lungs)... ...	1	2	1	2	...	1	2	8	3	5	1	26
Typhoid Fever	3	1	2	1	2	3	...	...	1	1	...	14
Dysentery	1	2	...	...	...	1	...	...	...	...	...	4
Typhus	...	...	...	1	...	...	...	...	...	...	...	1
Erysipelas	...	...	...	...	...	...	1	...	...	...	...	1
Pneumonia...	...	...	...	...	...	...	2	2	1	1	...	6
Influenza...	...	...	...	...	...	...	1	1	...	...	...	2
T. B. & Syphilis	...	...	...	...	1	...	...	...	...	...	1	2
Ch. Enteritis & Syphilis ...	...	...	1	1	1	...	...	...		...	...	3
T. B. Enteritis	...	2	...	...	...	...	..	...	...	...	...	2
Heart Disease	1	...	...	...	...	...	1	1	...	...	...	3
Nephritis	...	...	1	...	...	...	...	...	...	1	...	2
Apoplexy	...	...	...	...	...	...	...	...	1	...	...	1
Relapsing Fever	..	...	...	...	...	1	...	...	...	...	...	1
Emphysema	...	...	...	1	...	1	...	1	...	...	...	3
Paralysis Agitans	...	...	...	...	...	1	...	2	...	...	...	3
Epilepsy...	...	...	...	...	...	...	1	1	...	...	1	3
Hemiplegia	...	...	...	...	...	1	...	1	...	...	..	2
Pleurisy	...	1	...	...	...	...	...	...		...	..	1
Dropsy	...	...	1	...	...	...	...	...	...	...	...	1
Appendicitis	...	1	...	...	...	1	...	...	...	...	...	2
Meningitis	1	...	...	...	...	...	...	...	...	...	...	1
Collapse...	...	...	1	...	...	...	...	...	..	...	...	1
Carbuncle	...	...	...	...	...	...	...	1	...	...		1
Opium Poisoning...	1	...	...	...	...	...	...	...	...	...	..	1
Alcohoism	...	...	...	...	1	...	...	2	...	...	...	3
Chinese Drugs Poisoning...	...	...	...	1	...	...	...	...	...	...	...	1
Morphinism	...	1	...	2	1	1	2	2	1	...	...	10
Intestinal Obstruction ...	...	...	...	...	...	1	...	...	...	1	...	2
Total	10	9	6	9	6	12	10	22	7	9	3	103

On the average 9 corpses were found in the streets per month. The people are all anxious to get rid of sick persons from their houses, and often throw them out into the streets.

At night they often deposit corpses some little way away from their houses, in order to avoid investigation and to save burial expenses.

Investigations on tarabagan plague.

On the 9th September 1921, I received a telegram from Dr. Jitzer in Borzia, Transbaikalia, informing me that he had found plague bacilli in some tarabagans round about Soktu. I duly reported to the Harbin headquarters and was instructed to investigate this question. On arrival, I found there were three tarabagans in question. From one of them B. Pestis was recovered with certainty, as proved by bacteriological and animal tests. From the bodies of these tarabagans many fleas were caught, and the Russian doctor claimed to have seen B. Pestis in one of them. He believed that the flea transmits plague from tarabagan to man in the same manner as the rat flea does in bubonic plague. This theory, however, has yet to be proved by experiment.

I was able to obtain slides and cultures and a flea for transmission to Harbin for further confirmation.

Disinfection of tarabagan skins for export.

Since the plague epidemic in 1921, the export of tarabagan skins from Siberia was stopped by the Chinese authorities. But as these are valuable merchandise, and large stocks have been stored up, the merchants and the railway authorities petitioned the Director of the Plague Prevention Service to obtain permission from the Governor General of the Three Eastern Provinces to allow the export of these skins.

The condition for exportation was that the skins must be disinfected by us with formalin gas. The Customs and Post Office co-operated with us, so that without our certificate, no skins could be transported.

So for a period of 5 days November and 12 days in December, 1921, 12856 skins were examined and disinfected by us. Much labour was involved as the skins had to be put on shelves and fumigated with formalin gas generated by the action of Pot permanganate on formaldehyde.

Anti-bubonic plague work.

When the station-master of Dauria, 60 versts from Manchouli, was alleged to have been infected with bubonic plague through skinning a tarabagan and eating the meat in August, 1921, and 5 persons were shortly afterwards attacked by the same disease, we at once called a meeting of the local authorities and doctors to devise means to prevent the spread of plague into Manchuria.

House to house inspection was started, train passengers were examined, our plague hospital was got ready to receive patients, and the Zabaikal doctors were enjoined to watch the plague patients and contacts and to control the railway traffic. Fortunately no more cases developed.

Anti-typhus work.

The first case of typhus was discovered in the prison in Manchouli on the 14th November, 1921. Within five days, three other prisoners were infected with one death.

Between the 21st and 27th. 7 more typhus cases were admitted into the Municipal Hospital; of these 4 came from Zabaikalia.

From thence onwards till April, 1922, 229 Russian cases including 74 from Zabaikalia were reported with 26 deaths.

Strange to say, only three Chinese including 2 prisoners were affected, though the Chinese form at least half the population, and most of them possess very little knowledge of hygiene and sanitation.

Some of the anti-typhus work may be mentioned. Pamphlets were circulated to explain to the public the nature and methods of prevention. The inspection of the corpses was kept up and house to house inspection was restarted. The inspection of train passengers was again instituted. Our hospital was ready to receive Chinese typhus cases, but there were but few for admission.

A clinical picture of a typical typhus case is as follows :—

The patient complained of chills first and then high fever. On the third day rash appeared on the abdomen and extremities. He felt nauseous and was mildly delirious on the 3rd. or 4th. day. The eyes were congested and the patient often became dealf and weak. The highest temperature observed was 105°F.

The Russian doctors used the following treatment 5 c.c. of sterilized milk was injected into the gluteal muscle. 2 c.c. of Ol Camph. was given hypodermically daily until the fever abated. Then 10 minims of liq. strych. was given three times daily until recovery was complete.

The inspection of trains and streets.

At the time of outbreak of bubonic plague in Soktu in Zabaikal, we inspected the bi-monthly trains from the west. At the time of the typhus epidemic, the trains came twice weekly. Each train contained about 50 passengers, mostly Russians with only 3-4 Chinese. Very few typhus case were seen among them. They travelled to Manchouli by carts as we had occasion to find out in our house-to-house inspection work during a period of four months when 74 typhus in all were rounded up.

This work was kept up during the bubonic and typhus epidemics and is still kept up now because we believe we can spread the knowledge of sanitation to the public by telling them some plain and simple facts, and to persuade them to obtain scientific treatment instead of going to the old style Chinese quacks.

MISCELLANEOUS.

Population.

There are 2868 houses in Manchouli, of these 1246 are Chinese and the remaining Russian.

	Male.	*Female.*	*Total.*
Chinese	5249	269	5518
Russian	7168	8797	15965

Hospitals.

Railway hospital	1
Public Hospital	1
Antiplague Hospital	1
Japanese Hospital	1
Chinese Hospital	2
Total......	6

The Public Hospital is managed by the local Municipality with two Russian physicians in charge. The railway hospital is controlled by two Russians. The Anti-Plague Hospital is under the Plague Prev. Service, Harbin, and is managed by a Chinese Medical Officer. The two Chinese and Japanese hospitals are private ones and not well equipped with medical instruments, though they use foreign medicines. Besides the above there was a Red Cross Hospital in Manchouli, but it was closed up two months ago. No hospital using Chinese medicines exists.

Physicians.

	Antiplague hospital	1	Chinese
	Railway Hospital	2	Russian
Practice in Hosp.	Public Hospital	2	,,
	Chinese Hospital	2	,,
	Japanese Hospital	1	Japanese
Private Practice	Russians	5	
	Chinese	16	
	Total......	29	

The 16 Chinese physicians all use Chinese medicines, and have no medical certificates whatever. They will soon have to undergo an examination by the Chinese authorities.

Drug stores.

Russians	8	
Japanese	3	(the largest one has been closed)
Chinese	9	(Selling Chinese medicines)
Total	20	

Prostitutes

	Brothels.	*Prostitutes.*
Chinese	33	129
Russian	5	45
Japanese	5	20
Total	43	194

From the above mentioned number of physicians, excluding 16 Chinese physicians, and the number of drug stores, we may readily see in comparison with the population that there are about 1650 people to one physician and 1574 people to one drug store at Manchouli in ordinary times.

Y. M. KWAN, *Res. M.O.*

REVISED REGULATIONS FOR THE APPOINTMENT AND PROMOTION OF MEDICAL OFFICERS.

In order to increase the efficiency of the Service and to improve the prospects of Medical Officers, the following "Revised Regulations for the appointment and promotion of Medical Officers" have been drawn up after consultation between the Director and C. M. O. and the Lay Director and Treasurer.

1. Medical Officers are appointed by the Director and Chief Medical Officer whose orders they must obey and to whom they are responsible for the satisfactory performance of their duties.

2. There are two classes of Medical Officers—Senior Medical Officers and Assistant Medical Officers.

3. *Senior Medical Officers* (正醫官) are chosen by virtue of their having graduated from a recognised European, American or Japanese University, or by virtue of their being graduates of at least ten years standing of a Government Medical College and having since been in continuous medical practice.

Senior Medical Officers are of the following grades—counting from the junior grades :—

	Grade.		*Rate of salary per month.*
4th.	Senior M.O.	B.	$ 300.
	,,	A.	325.
3rd.	Senior M. O.	B.	350.
	,,	A.	375.
2nd.	Senior M.O.	B.	400.
	,,	A.	425.
1st.	Senior M. O.	B.	450.
	,,	A.	475.

The rates of salaries of Senior Medical Officers which have been fixed prior to the promulgation of these regulations will remain as before.

Senior Medical Officers are allowed single furnished quarters at the hospitals to which they are appointed, or in lieu, a monthly rent allowance of $50.

Senior Medical Officers receive in addition a fuel allowance of $15. per mensem, on the understanding that they do not consume any fuel belonging to the Service.

4. *Assistant Medical Officers* (副醫官) are chosen from among the graduates of recognised medical schools in China. They are of the following grades, beginning with the junior:—

4th. Asst. M. O.	B.	$ 100.
,,	A.	115.
3rd. Asst. M. O.	B.	130.
,,	A.	145.
2nd. Asst. M. O.	B.	160.
,,	A.	175.
1st. Asst. M. O.	B.	200.
,,	A.	225.

Assistant Medical Officers are expected to live in the Hospital to which they are appointed; for this purpose furnished quarters are provided.

Assistant Medical Officers receive in addition a fuel allowance of $15 per mensem, on the understanding that they do not consume any fuel belonging to the Service.

5. Promotion of Medical Officers in the Service will be made as far as possible every year, but only after the following conditions have been fulfilled:—

a. That they show satisfactory progress in the work entrusted to them.
b. That they are able to pass an examination fixed by the C. M. O. according to their rank.
c. That they show a sufficient knowledge of Chinese and English for the purpose of their work.
d. That their general record is satisfactory.

6. *Leave.* In order to allow Medical Officers to improve their knowledge, special arrangements will be made by the C. M. O. by which Assistant Medical Officers will be able to stay for some months in Harbin and receive instruction in Bacteriology and other subjects connected with Preventive Medicine.

Besides the above, facilities will be given to Assistant Medical Officers to obtain leave to take up post-graduate work in one of the larger medical colleges in China, e.g. Hongkong University, Rockefeller Medical School. Leave for this purpose will extend from three to six months. Assistant Medical Officers will draw their regular salaries whilst they are pursuing this course of studies, but part or whole of this may be stopped unless the C. M. O. receives from the proper authorities satisfactory reports of their progress. No Assistant Medical Officer will be allowed this privilege unless he has been at least three years in the employ of the Service.

In the case of Senior Medical Officers, if circumstances permit, six months' leave will be allowed for purposes of study in Europe or America after they have been at least four years in the employ of the Service. During these six months, they will receive per mensem a sum equal to 2/3 of their regular salary, but no allowance. Leave may be extended for an extra three months after the completion of the regular six months, but in such a case, no salary will be paid by the Service.

7. The above regulations will take effect from the 1st. September, 1914. They are experimental and subject to amendment as experience may teach.

8. The other regulations relating to Medical Officers already published in the "General Regulations" will remain as heretofore.

Harbin, 15th August, 1914. Revised in 1920.

REGULATIONS AND SCALE OF SALARIES FOR THE ASSISTANT STAFF OF THE SERVICE.

The following instructions are issued by the Director and Chief Medical Officer for the guidance of members of the Assistant Staff of the Service

Members of the Assistant Staff are divided into:—

Probationers.	
Junior Dressers	2nd. class.
,,	1st. ,,
Senior Dressers	2nd. ,,
,,	1st. ,,
Junior Dispensers	2nd. ,,
,,	1st. ,,
Senior Dispensers	2nd. ,,
,,	1st. ,,

Probationers.

These are students on first entrance into the Service. They must come of respectable family, be properly recommended, have a fair knowledge of Chinese and not be above 16 years of age. They will receive their training at the Harbin Hospital for six months, during which they receive a food allowance of $6.00 per mensem, and sundry allowance for uniform, shoes, hair-cutting, etc., as occasion demands. At the end of this period, which they must spend in the Dressing Room, they are examined and if found proficient are drafted into 2nd. Class Junior Dressers.

Junior Dressers.

These are of two Classes. 1st. and 2nd. Class, and their salaries as follows:—

2nd. Class Junior Dresser	$15.00
1st. ,, ,, ,,	20.00

No allowances are given except for official uniform, and to ensure the expenditure of a proper sum on food the Senior Medical Officer is authorised to deduct every month a certain sum from their salary for food.

Promotions are made every year, but the Dresser must show proficiency in his work as well as good behaviour.

Quicker promotion may be made in special cases, especially when the Dresser shows a working knowledge of English. Examinations are held about the middle of June and December, their progress will be noted and marks given accordingly.

Senior Dressers.

There are of two classes (1st and 2nd) and their salaries as follows :—

2nd. Class Senior Dresser	$25.00
1st ,, ,, ,,	30.00

Senior Dressers are promoted from Student Dressers, but before they are promoted to this rank, they must show a general knowledge of hospital and sanitary work and enough English to be able to read prescriptions and names of drugs. Ordinary promotions take place every year, but when extra zeal and intelligence are shown, special promotions may be made.

Dispensers.

They are divided into Junior and Senior, each of 1st and 2nd Class. Rates of salaries are as follows :—

Junior Dispenser 2nd Class	$35.00
,, ,, 1st ,,	40.00
Senior Dispenser 2nd ,,	45.00
,, ,, 1st ,,	50.00

Dispensers are expected to have a satisfactory knowledge of the routine work of a hospital, of ordinary dispensing and sanitary work. In this category are classed Sanitary Inspectors, whose work will be outlined by the C.M.O. for assisting the Public Health authorities. Arrangements will be made for the work of Sanitary Inspector being relieved by the Dispenser when necessary and vice-versa.

Every encouragement will be given to Dispensers for the further prosecution of their knowledge, and extra allowances given in case of zeal and intelligence.

Certificates will also be issued by the C.M.O. in cases of proficiency.

Members of the Assistant Staff must be ready to proceed to any station when instructed by C.M.O.

N.B.—The above Regulations are Experimental only and may be revised or altered at any time by the C. M. O.

Harbin, November 12th, 1919.

PROPOSED SCHEME OF SUPERANNUATION FUND FOR THE STAFF OF THE NORTH MANCHURIAN PLAGUE PREVENTION SERVICE.

Higher Staff. The Higher Staff consists of:—

Directors,
Medical Officers,
Nurses.
Dressers,
Accountants,
Secretaries,
Writers, etc.

The contributions of the Higher Staff of the Service are subject to the following stipulations:—

1. A deduction of 10% from the monthly substantive pay shall be made at the end of the mouth—the deduction for any member however not to exceed silver $50.00.

2. The Service will contribute on its part a sum equal to that deducted from the salary of the employee, but not in any case to exceed silver $50.00.

3. The money thus, contributed and deducted will be deposited with a reliable local bank on fixed deposit, the interest accruing thereon will be credited to the amount of each participant at the end of the fiscal year according to his share in the fund.

4. A statement will be handed annually to each participant showing his contributions to date and what he has earned.

5. No participant will be allowed to make any withdrawals from the fund as long as he remains in the Service.

6. After three full years of service a participant who leaves is entitled to receive the whole sum accumulated under his name (*vide* 8).

7. To those who withdraw before the expiry of three full years in the Service only the portion deducted from their salaries together with the interest accrued thereon shall be paid and they shall have no claim on the share contributed by the Service, which shall, together with the interest that has accrued thereon, revert to the Service (*vide* 9).

8. The following are exceptions to (6) :—
Those who are discharged on account of
(a) misconduct,
(b) neglect of duty,
(c) disobedience,
(d) dishonesty,
(e) any cause that is contrary to honourable discharge.
(f) those who leave the Service without due notice.

In such cases a participant will not be entitled to the share contributed by the Service but shall receive back the deductions made from the salaries together with accrued interest, but should the Service have sustained any loss owing to dishonesty, malfeasance, criminal carelessness, etc., the amount of such loss shall be deducted.

9. The following are exceptions to (7) :—
(a) In case of death; or of sickness contracted through no fault of his own and incapacitating him from further service.
(b) In case of incapacity caused by accidents while on duty.
(c) Any form of honourable discharge, under which conditions, although less than three years in the Service, a participant will be allowed the money contributed by the Service (plus accrued interest there on) in his favour.

10. Special Accounts shall be opened by the Accountant to take care of the contributions, receipts and payments appearing under "Extraordinary." The funds will be deposited in a reputable local Bank as determined by the Directors, shall lie in the Bank on fixed deposit, and at the end of each fiscal year the Accountant shall advise each participant what is due him in principal and interest (*vide* 3 and 4).

11. The above stipulations shall be compulsory on all members of the Higher Staff.

Lower Staff. The Lower Staff comprises :—
Cooks,
Watchmen,
Sanitary Attendants,
Coolies,
Gardeners, etc.

Members of the Lower Staff are entitled to the following benefits :—

12. On the completion of each full year's service the Service will contribute one month's pay which sum will be paid into the Fund and draw interest in the same manner as the contributions of the Higher Staff.

13. This sum shall be considered purely as a contribution on the part of the Service and is subject to the same regulations in the matter of withdrawal from the Service by the employee as the contributions of the Service to the Higher Staff.

14. In the case of death of a Lower Employee while in Service an additional issue will be made to his estate of two months post mortem pay.

Customs Staff.

15. The participation of the Staff of the Chinese Customs drawing allowances from the Service for services performed in its behalf shall be optional.

General.

16. The English version of these regulations is to be authoritative in the case of any dispute. Should there be a dispute over any point the decisions of the Directors shall be final. They shall also be the authority to determine the circumstances under which the employee left the Service and to what benefits he is entitled.

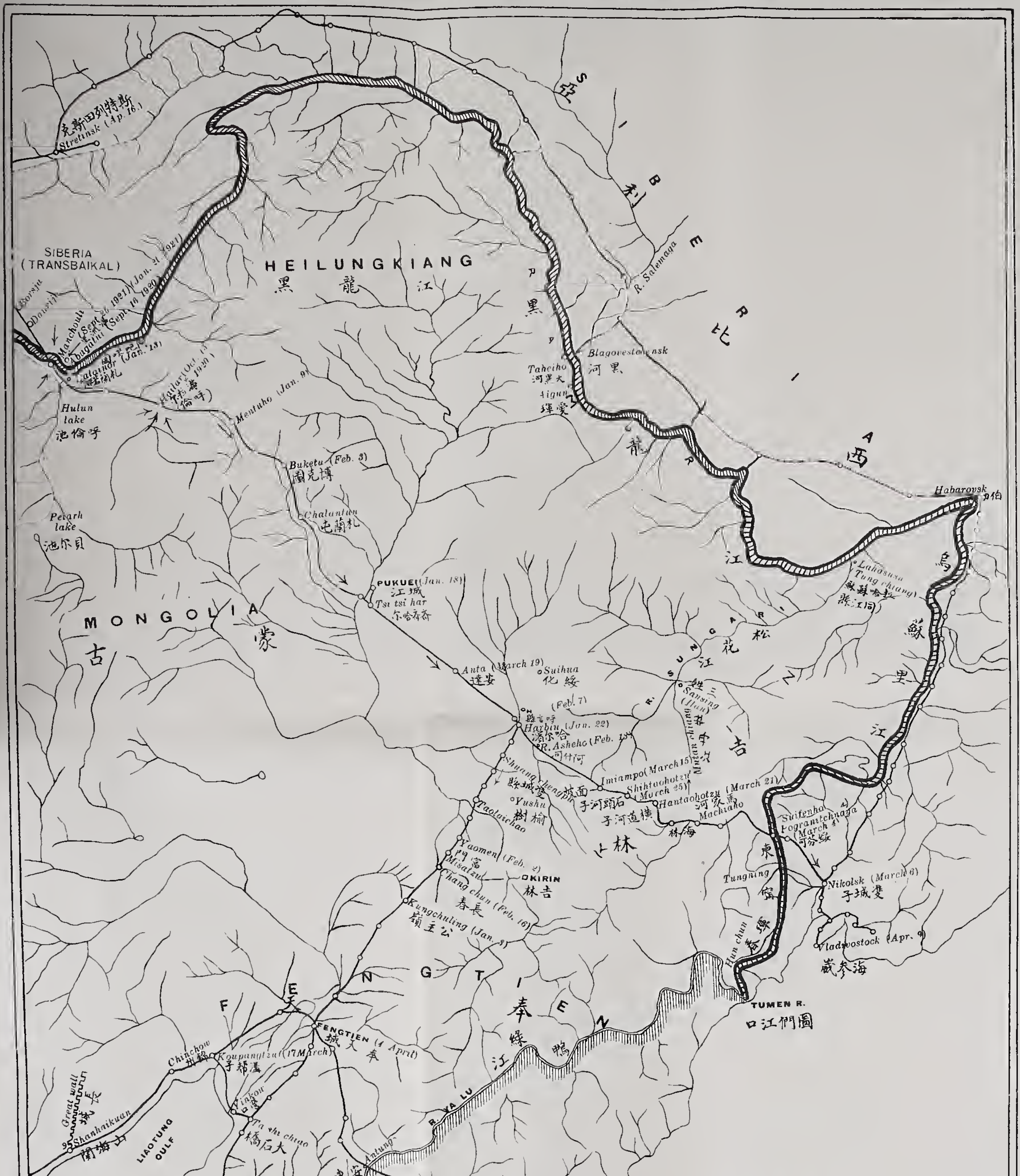
17. In the case of death of any participant of the above benefits the amounts due are to be paid to his immediate estate (after deduction of funeral expenses, if any, and any sums due the Service) and are not subject to any claims by outside parties.

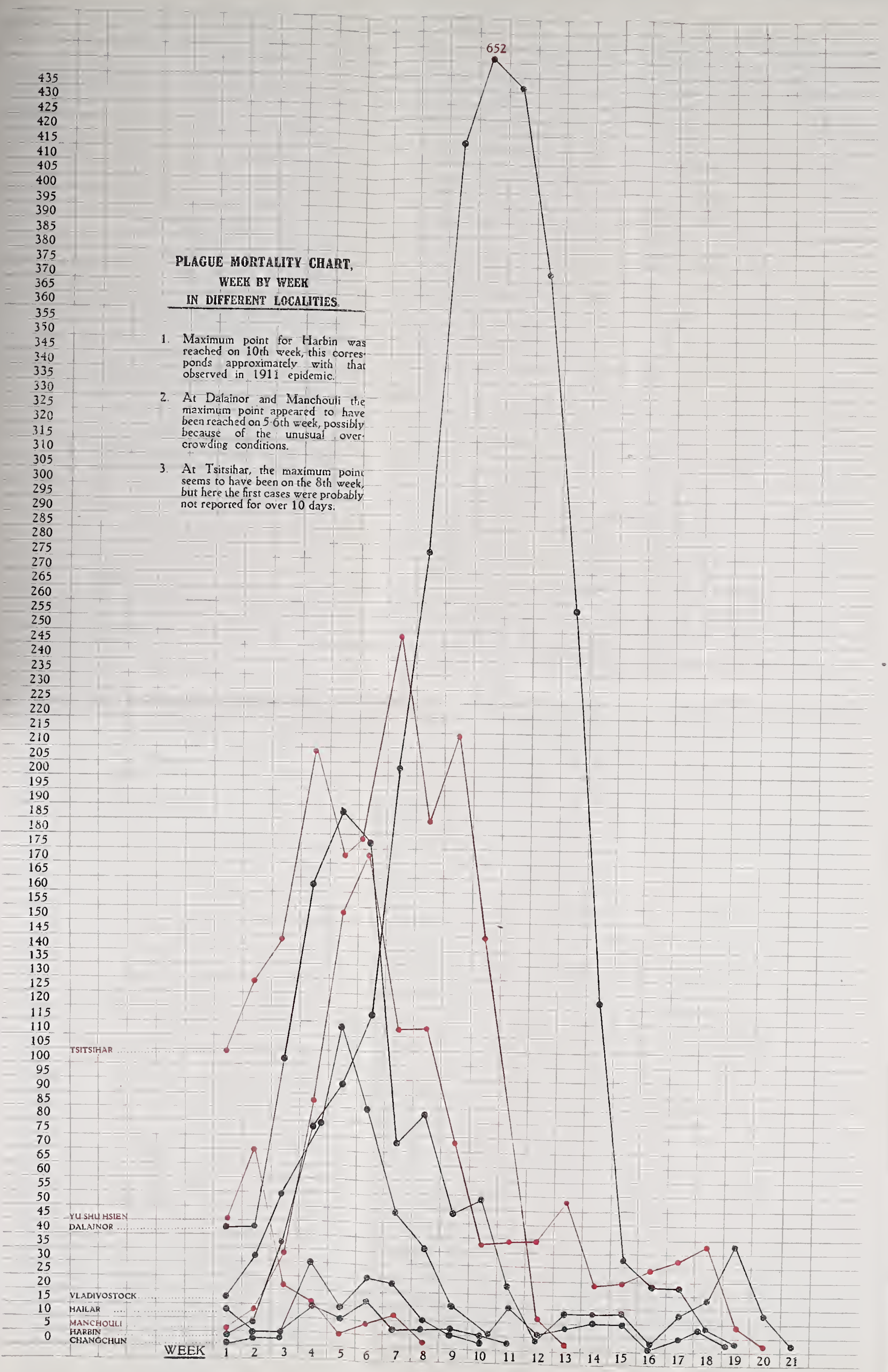
18. Where there is no immediate estate or the Directors feel that there is no *bona fide* claimants the amounts paid in by the deceased together with the interest thereon shall be divided up amongst the active participators of the scheme, the amounts contributed by the Service and interest thereon reverting to the Service.

東三省發生肺疫各地詳圖

MAP OF PLAGUE REGION, MANCHURIA, 1921.

Dates after names indicate first cases recorded; arrows indicate first invasion of plague 1920.



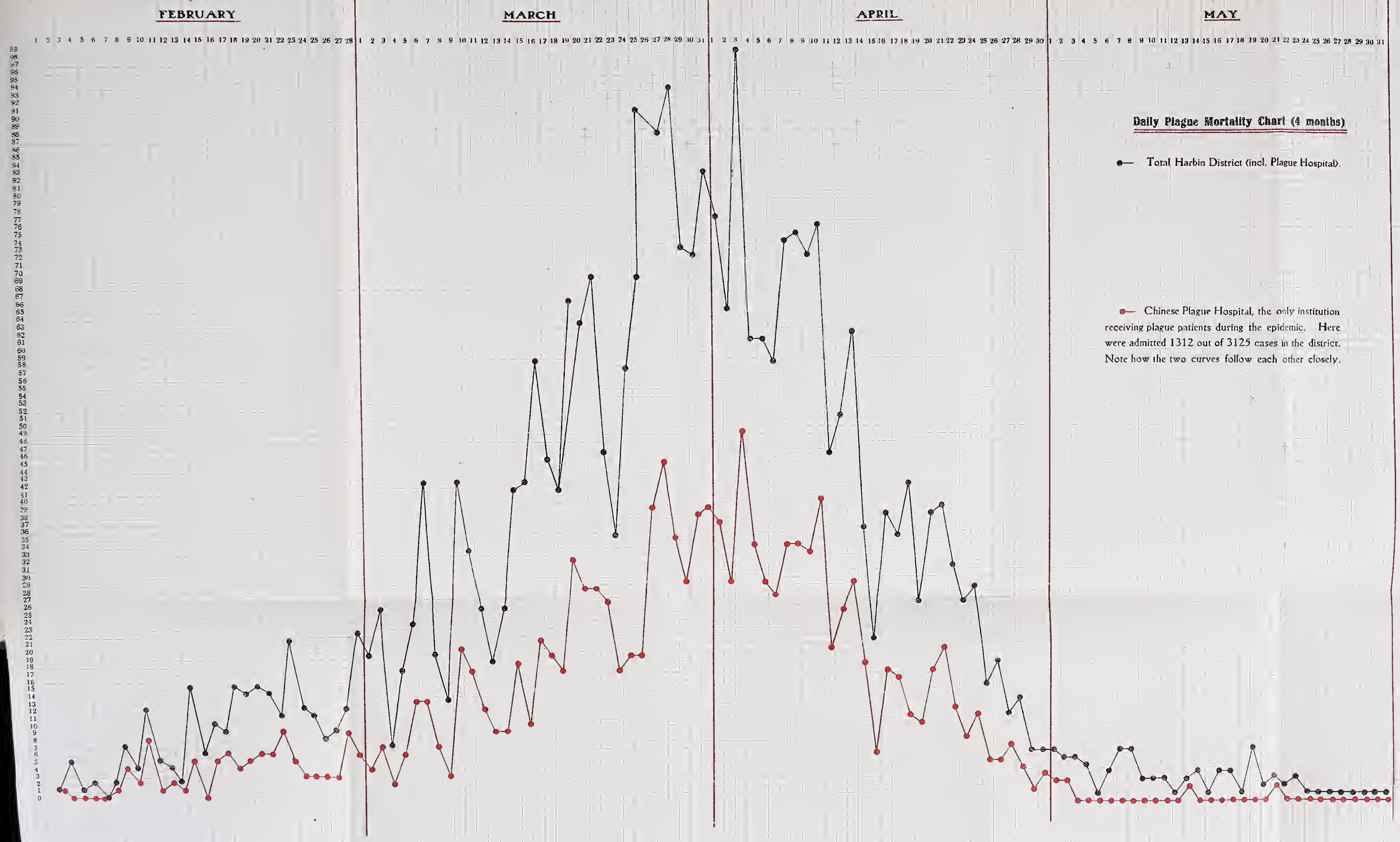


PLAGUE MORTALITY CHART, WEEK BY WEEK IN DIFFERENT LOCALITIES.

1. Maximum point for Harbin was reached on 10th week, this corresponds approximately with that observed in 1911 epidemic.

2. At Dalainor and Manchouli the maximum point appeared to have been reached on 5-6th week, possibly because of the unusual overcrowding conditions.

3. At Tsitsihar, the maximum point seems to have been on the 8th week, but here the first cases were probably not reported for over 10 days.



Daily Plague Mortality Chart (4 months)

●— Total Harbin District (incl. Plague Hospital).

●— Chinese Plague Hospital, the only institution receiving plague patients during the epidemic. Here were admitted 1312 out of 3125 cases in the district. Note how the two curves follow each other closely.